

Advanced Information

- 262 144 words by 16-bit organization
- 0 to 70 °C operating temperature
- Fast access and cycle time
- $\overline{\text{RAS}}$ access time:
 - 50 ns (-50 version)
 - 55 ns (-55 version)
 - 60 ns (-60 version)
- $\overline{\text{CAS}}$ access time:
 - 13 ns (-50 & -55 version)
 - 15 ns (-60 version)
- Cycle time:
 - 89 ns (-50 version)
 - 94 ns (-55 version)
 - 104 ns (-60 version)
- Hyper page mode (EDO) cycle time
 - 20 ns (-50 & -55 version)
 - 25 ns (-60 version)
- High data rate
 - 50 MHz (-50 & -55 version)
 - 40 MHz (-60 version)
- Single + 5 V ($\pm 10\%$) supply with a built-in V_{BB} generator
- Low Power dissipation
 - max. 1100 mW active (-50 version)
 - max. 1045 mW active (-55 version)
 - max. 935 mW active (-60 version)
- Standby power dissipation
 - 11 mW standby (TTL)
 - 5.5 mW max. standby (CMOS)
- Output unlatched at cycle end allows two-dimensional chip selection
- Read, write, read-modify write, $\overline{\text{CAS}}$ -before- $\overline{\text{RAS}}$ refresh, $\overline{\text{RAS}}$ -only refresh, hidden-refresh and hyper page (EDO) mode capability
- 2 $\overline{\text{CAS}}$ /1 $\overline{\text{WE}}$ control
- All inputs and outputs TTL-compatible
- 512 refresh cycles/16 ms
- Plastic Packages:
 - P-SOJ-40-1 400 mil width

The HYB 514175BJ is the new generation dynamic RAM organized as 262 144 words by 16-bit. The HYB 514175BJ utilizes CMOS silicon gate process as well as advanced circuit techniques to provide wide operation margins, both internally and for the system user. Multiplexed address inputs permit the HYB 514175BJ to be packed in a standard plastic 400 mil wide P-SOJ-40-1 package. This package size provides high system bit densities and is compatible with commonly used automatic testing and insertion equipment. System oriented features include single + 5 V (± 10 %) power supply, direct interfacing with high performance logic device families such as Schottky TTL.

Ordering Information

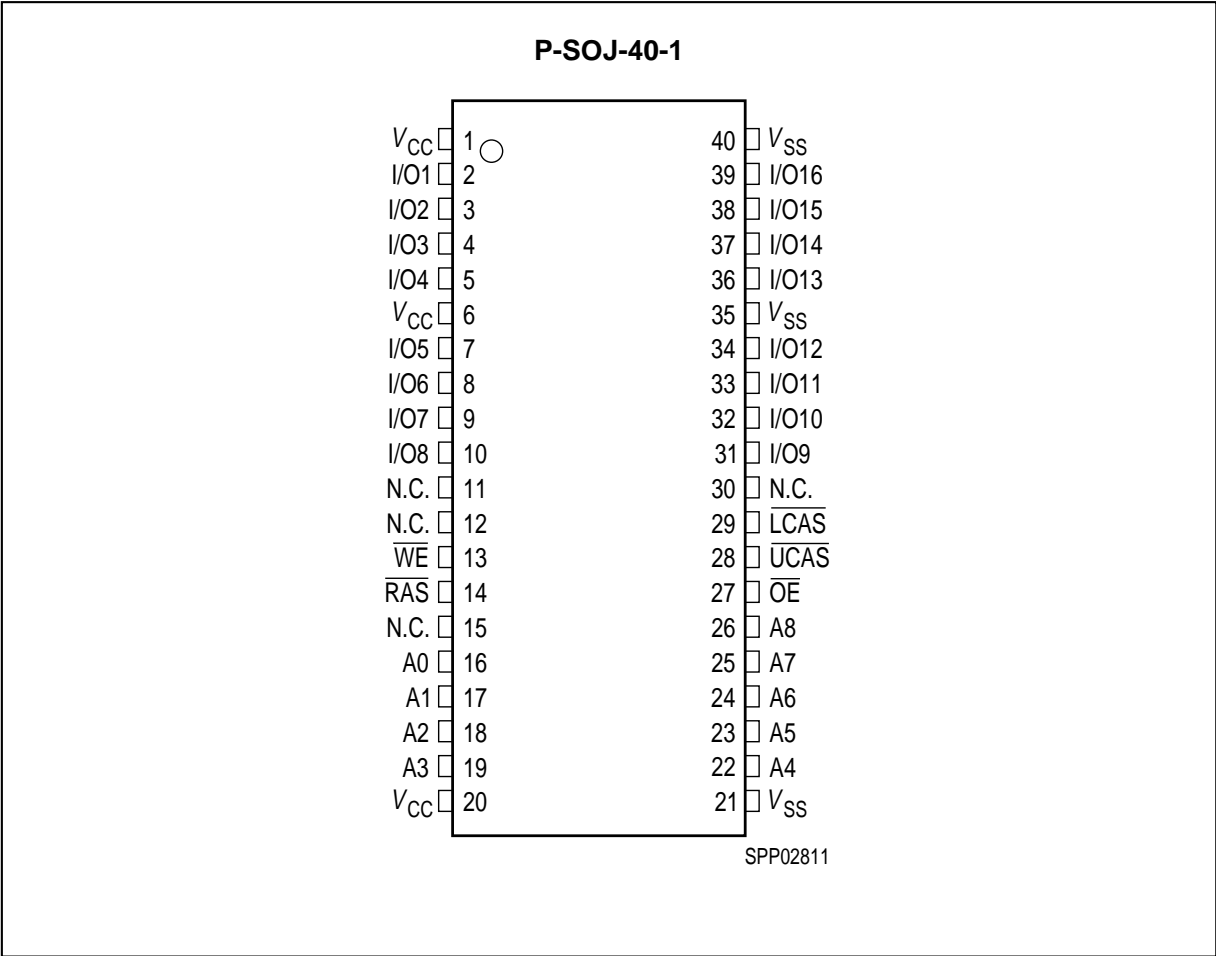
| Type | Ordering Code | Package | Description |
|-----------------|---------------|--------------------|--------------------------|
| HYB 514175BJ-50 | Q67100-Q2072 | P-SOJ-40-1 400 mil | 50 ns 256k × 16 EDO-DRAM |
| HYB 514175BJ-55 | Q67100-Q2100 | P-SOJ-40-1 400 mil | 55 ns 256k × 16 EDO-DRAM |
| HYB 514175BJ-60 | Q67100-Q2073 | P-SOJ-40-1 400 mil | 60 ns 256k × 16 EDO-DRAM |

Truth Table

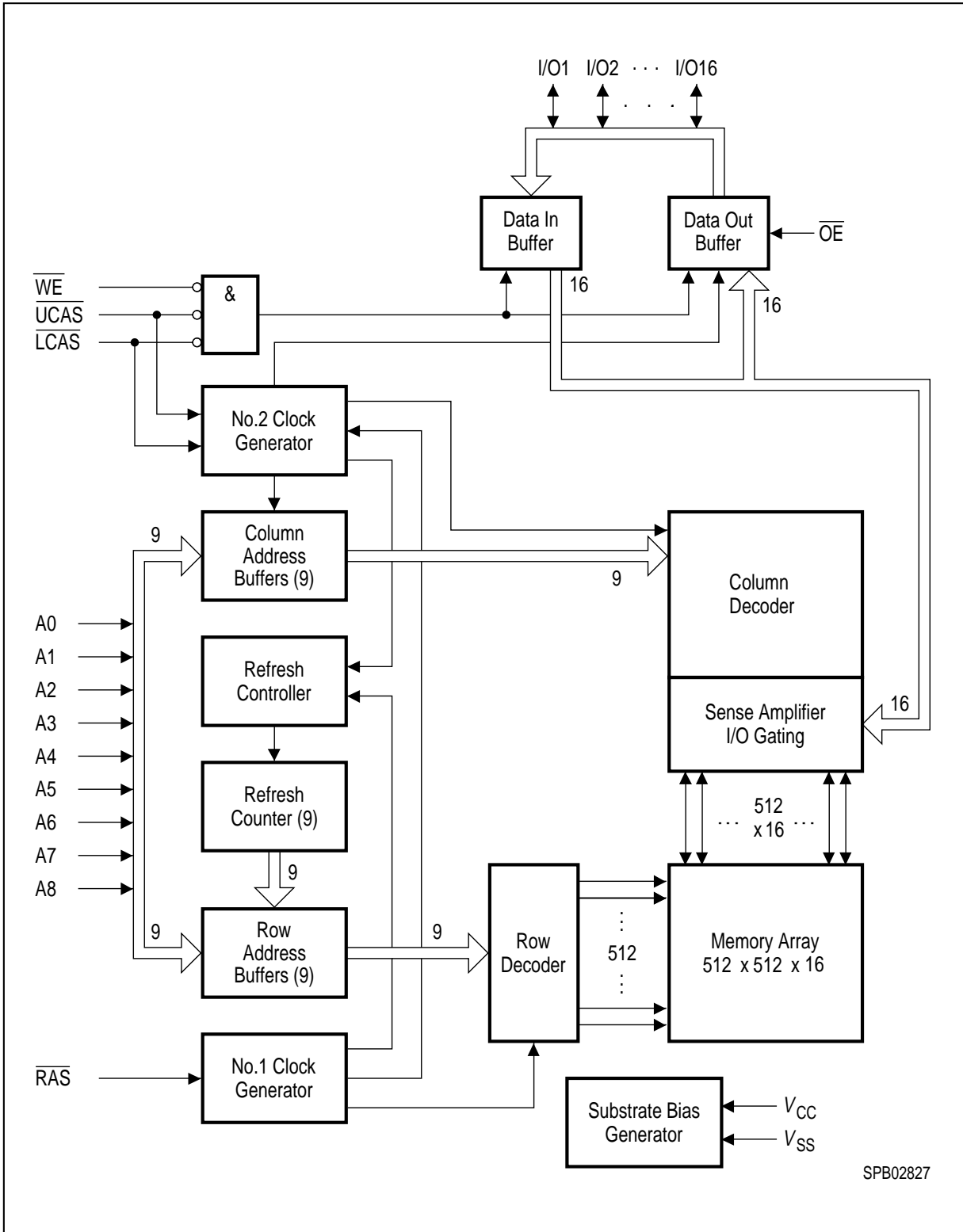
| RAS | LCAS | UCAS | WE | OE | I/O1 - I/O8 | I/O9 - I/O16 | Operation |
|-----|------|------|----|----|-------------|--------------|------------------|
| H | H | H | H | H | High-Z | High-Z | Standby |
| L | H | H | H | H | High-Z | High-Z | Refresh |
| L | L | H | H | L | Dout | High-Z | Lower byte read |
| L | H | L | H | L | High-Z | Dout | Upper byte read |
| L | L | L | H | L | Dout | Dout | Word read |
| L | L | H | L | H | Din | Don't care | Lower byte write |
| L | H | L | L | H | Don't care | Din | Upper byte write |
| L | L | L | L | H | Din | Din | Word write |
| L | L | L | H | H | High-Z | High-Z | – |

Pin Names

| | |
|-----------------|-----------------------|
| A0 - A8 | Address Inputs |
| RAS | Row Address Strobe |
| UCAS, LCAS | Column Address Strobe |
| WE | Read/Write Input |
| OE | Output Enable |
| I/O1 -I/O16 | Data Input/Output |
| V _{CC} | Power Supply (+ 5 V) |
| V _{SS} | Ground (0 V) |
| N.C. | No Connection |



Pin Configuration
(top view)



Block Diagram

Absolute Maximum Ratings

| | |
|--|------------------|
| Operating temperature range | 0 to + 70 °C |
| Storage temperature range..... | - 55 to + 150 °C |
| Input/output voltage | - 1 to + 6 V |
| Power supply voltage..... | - 1 to + 6 V |
| Data out current (short circuit) | 50 mA |

Note: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage of the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC Characteristics

$T_A = 0$ to 70 °C; $V_{SS} = 0$ V; $V_{CC} = 5$ V \pm 10 %, $t_T = 2$ ns

| Parameter | Symbol | Limit Values | | Unit | Test Condition |
|--|------------|--------------|-------------------|---------|----------------|
| | | min. | max. | | |
| Input high voltage | V_{IH} | 2.4 | $V_{CC} + 0.5$ | V | 1 |
| Input low voltage | V_{IL} | - 1.0 | 0.8 | V | 1 |
| Output high voltage ($I_{OUT} = - 5.0$ mA) | V_{OH} | 2.4 | - | V | 1 |
| Output low voltage ($I_{OUT} = 4.2$ mA) | V_{OL} | - | 0.4 | V | 1 |
| Input leakage current, any input (0 V < $V_{IN} < 7$ V, all other inputs = 0 V) | $I_{I(L)}$ | - 10 | 10 | μ A | 1 |
| Output leakage current (DO is disabled, 0 V < $V_{OUT} < V_{CC}$) | $I_{O(L)}$ | - 10 | 10 | μ A | 1 |
| Average V_{CC} supply current -50 version -55 version -60 version | I_{CC1} | - | 200 190 170 | mA | 2, 3, 4 |
| Standby V_{CC} supply current ($\overline{RAS} = \overline{LCAS} = \overline{UCAS} = \overline{WE} = V_{IH}$) | I_{CC2} | - | 2 | mA | |
| Average V_{CC} supply current during \overline{RAS} -only refresh cycles -50 version -55 version -60 version | I_{CC3} | - | 200 190 170 | mA | 2, 4 |
| Average V_{CC} supply current during hyper page mode (EDO) operation -50 version -55 version -60 version | I_{CC4} | - | 190 180 170 | mA | 2, 3, 4 |

DC Characteristics (cont'd)

$T_A = 0$ to 70 °C; $V_{SS} = 0$ V; $V_{CC} = 5$ V \pm 10 %, $t_T = 2$ ns

| Parameter | Symbol | Limit Values | | Unit | Test Condition |
|---|-----------|--------------|------|------|----------------|
| | | min. | max. | | |
| Standby V_{CC} supply current ($\overline{RAS} = \overline{LCAS} = \overline{UCAS} = \overline{WE} = V_{CC} - 0.2$ V) | I_{CC5} | – | 1 | mA | 1 |
| Average V_{CC} supply current during \overline{CAS} -before- \overline{RAS} refresh mode | I_{CC6} | – | | mA | 2, 4 |
| -50 version | | | 200 | | |
| -55 version | | | 190 | | |
| -60 version | | | 170 | | |

Capacitance

$T_A = 0$ to 70 °C; $V_{CC} = 5$ V \pm 10 %, $f = 1$ MHz

| Parameter | Symbol | Limit Values | | Unit |
|--|----------|--------------|------|------|
| | | min. | max. | |
| Input capacitance (A0 to A8) | C_{I1} | – | 5 | pF |
| Input capacitance (\overline{RAS} , \overline{UCAS} , \overline{LCAS} , \overline{WE} , \overline{OE}) | C_{I2} | – | 7 | pF |
| Output capacitance (I/O1 to I/O16) | C_{IO} | – | 7 | pF |

AC Characteristics ^{5, 6}

$T_A = 0$ to 70 °C; $V_{SS} = 0$ V; $V_{CC} = 5$ V \pm 10 %, $t_T = 2$ ns

| Parameter | Symbol | Limit Values | | | | | | Unit | Note |
|---|-----------|--------------|------|------|------|------|------|------|------|
| | | -50 | | -55 | | -60 | | | |
| | | min. | max. | min. | max. | min. | max. | | |
| Random read or write cycle time | t_{RC} | 89 | – | 94 | – | 104 | – | ns | |
| \overline{RAS} precharge time | t_{RP} | 35 | – | 35 | – | 40 | – | ns | |
| \overline{RAS} pulse width | t_{RAS} | 50 | 10k | 55 | 10k | 60 | 10k | ns | |
| \overline{CAS} pulse width | t_{CAS} | 8 | 10k | 8 | 10k | 10 | 10k | ns | |
| Row address setup time | t_{ASR} | 0 | – | 0 | – | 0 | – | ns | |
| Row address hold time | t_{RAH} | 8 | – | 8 | – | 10 | – | ns | |
| Column address setup time | t_{ASC} | 0 | – | 0 | – | 0 | – | ns | |
| Column address hold time | t_{CAH} | 8 | – | 8 | – | 10 | – | ns | |
| \overline{RAS} to \overline{CAS} delay time | t_{RCD} | 12 | 37 | 12 | 43 | 14 | 45 | ns | |
| \overline{RAS} to column address delay time | t_{RAD} | 10 | 25 | 10 | 30 | 12 | 30 | ns | |

Common Parameters

| | | | | | | | | | |
|---|-----------|----|-----|----|-----|-----|-----|----|--|
| Random read or write cycle time | t_{RC} | 89 | – | 94 | – | 104 | – | ns | |
| \overline{RAS} precharge time | t_{RP} | 35 | – | 35 | – | 40 | – | ns | |
| \overline{RAS} pulse width | t_{RAS} | 50 | 10k | 55 | 10k | 60 | 10k | ns | |
| \overline{CAS} pulse width | t_{CAS} | 8 | 10k | 8 | 10k | 10 | 10k | ns | |
| Row address setup time | t_{ASR} | 0 | – | 0 | – | 0 | – | ns | |
| Row address hold time | t_{RAH} | 8 | – | 8 | – | 10 | – | ns | |
| Column address setup time | t_{ASC} | 0 | – | 0 | – | 0 | – | ns | |
| Column address hold time | t_{CAH} | 8 | – | 8 | – | 10 | – | ns | |
| \overline{RAS} to \overline{CAS} delay time | t_{RCD} | 12 | 37 | 12 | 43 | 14 | 45 | ns | |
| \overline{RAS} to column address delay time | t_{RAD} | 10 | 25 | 10 | 30 | 12 | 30 | ns | |

AC Characteristics (cont'd)^{5, 6}

$T_A = 0$ to 70 °C; $V_{SS} = 0$ V; $V_{CC} = 5$ V \pm 10 %, $t_T = 2$ ns

| Parameter | Symbol | Limit Values | | | | | | Unit | Note |
|---------------------------------|-----------|--------------|------|------|------|------|------|------|--------------|
| | | -50 | | -55 | | -60 | | | |
| | | min. | max. | min. | max. | min. | max. | | |
| RAS hold time | t_{RSH} | 13 | – | 13 | – | 15 | – | ns | |
| CAS hold time | t_{CSH} | 40 | – | 45 | – | 50 | – | ns | |
| CAS to RAS precharge time | t_{CRP} | 5 | – | 5 | – | 5 | – | ns | |
| Transition time (rise and fall) | t_T | 1 | 50 | 1 | 50 | 1 | 50 | ns | ⁷ |
| Refresh period | t_{REF} | – | 16 | – | 16 | – | 16 | ms | |

Read Cycle

| | | | | | | | | | |
|---------------------------------------|-----------|----|----|----|----|----|----|----|------------------|
| Access time from RAS | t_{RAC} | – | 50 | – | 55 | – | 60 | ns | ^{8, 9} |
| Access time from CAS | t_{CAC} | – | 13 | – | 13 | – | 15 | ns | ^{8, 9} |
| Access time from column address | t_{AA} | – | 25 | – | 25 | – | 30 | ns | ^{8, 10} |
| OE access time | t_{OEA} | – | 13 | – | 13 | – | 15 | ns | |
| Column address to RAS lead time | t_{RAL} | 25 | – | 25 | – | 30 | – | ns | |
| Read command setup time | t_{RCS} | 0 | – | 0 | – | 0 | – | ns | |
| Read command hold time | t_{RCH} | 0 | – | 0 | – | 0 | – | ns | ¹¹ |
| Read command hold time ref. to RAS | t_{RRH} | 0 | – | 0 | – | 0 | – | ns | ¹¹ |
| CAS to output in low-Z | t_{CLZ} | 0 | – | 0 | – | 0 | – | ns | ⁸ |
| Output buffer turn-off delay from CAS | t_{OFF} | 0 | 13 | 0 | 13 | 0 | 15 | ns | ¹² |
| Output buffer turn-off delay from OE | t_{OEZ} | 0 | 13 | 0 | 13 | 0 | 15 | ns | ¹² |
| Data to OE low delay | t_{DZO} | 0 | – | 0 | – | 0 | – | ns | ¹³ |
| CAS high to data delay | t_{CDD} | 10 | – | 10 | – | 13 | – | ns | ¹⁴ |
| OE high to data delay | t_{ODD} | 10 | – | 10 | – | 13 | – | ns | ¹⁴ |

Write Cycle

| | | | | | | | | | |
|--------------------------------|-----------|----|---|----|---|----|---|----|---------------|
| Write command hold time | t_{WCH} | 8 | – | 8 | – | 10 | – | ns | |
| Write command pulse width | t_{WP} | 8 | – | 8 | – | 10 | – | ns | |
| Write command setup time | t_{WCS} | 0 | – | 0 | – | 0 | – | ns | ¹⁵ |
| Write command to RAS lead time | t_{RWL} | 13 | – | 13 | – | 15 | – | ns | |
| Write command to CAS lead time | t_{CWL} | 13 | – | 13 | – | 15 | – | ns | |
| Data setup time | t_{DS} | 0 | – | 0 | – | 0 | – | ns | ¹⁶ |
| Data hold time | t_{DH} | 8 | – | 8 | – | 10 | – | ns | ¹⁶ |
| Data to CAS low delay | t_{DZC} | 0 | – | 0 | – | 0 | – | ns | ¹³ |

AC Characteristics (cont'd)^{5, 6}

$T_A = 0$ to 70 °C; $V_{SS} = 0$ V; $V_{CC} = 5$ V \pm 10 %, $t_T = 2$ ns

| Parameter | Symbol | Limit Values | | | | | | Unit | Note |
|-----------|--------|--------------|------|------|------|------|------|------|------|
| | | -50 | | -55 | | -60 | | | |
| | | min. | max. | min. | max. | min. | max. | | |

Read-Modify-Write Cycle

| | | | | | | | | | |
|--|-----------|-----|---|-----|---|-----|---|----|---------------|
| Read-write cycle time | t_{RWC} | 118 | – | 122 | – | 138 | – | ns | |
| \overline{RAS} to \overline{WE} delay time | t_{RWD} | 64 | – | 69 | – | 77 | – | ns | ¹⁵ |
| \overline{CAS} to \overline{WE} delay time | t_{CWD} | 27 | – | 27 | – | 32 | – | ns | ¹⁵ |
| Column address to \overline{WE} delay time | t_{AWD} | 39 | – | 39 | – | 47 | – | ns | ¹⁵ |
| \overline{OE} command hold time | t_{OEH} | 10 | – | 10 | – | 13 | – | ns | |

Hyper Page Mode (EDO) Cycle

| | | | | | | | | | |
|--|------------|----|------|----|------|----|------|----|--------------|
| Hyper page mode cycle time | t_{HPC} | 20 | – | 20 | – | 25 | – | ns | |
| \overline{CAS} precharge time | t_{CP} | 8 | – | 8 | – | 10 | – | ns | |
| Access time from \overline{CAS} precharge | t_{CPA} | – | 27 | – | 27 | – | 32 | ns | ⁷ |
| Output data hold time | t_{COH} | 5 | – | 5 | – | 5 | – | ns | |
| \overline{RAS} pulse width in hyper page mode | t_{RAS} | 50 | 200k | 55 | 200k | 60 | 200k | ns | |
| \overline{RAS} hold time from \overline{CAS} precharge | t_{RHCP} | 27 | – | 27 | – | 32 | – | ns | |

Hyper Page Mode (EDO) Read-Modify-Write Cycle

| | | | | | | | | | |
|--|------------|----|---|----|---|----|---|----|--|
| Hyper page mode read/write cycle time | t_{PRWC} | 58 | – | 58 | – | 68 | – | ns | |
| \overline{CAS} precharge to \overline{WE} delay time | t_{CPWD} | 41 | – | 41 | – | 49 | – | ns | |

\overline{CAS} -before- \overline{RAS} Refresh Cycle

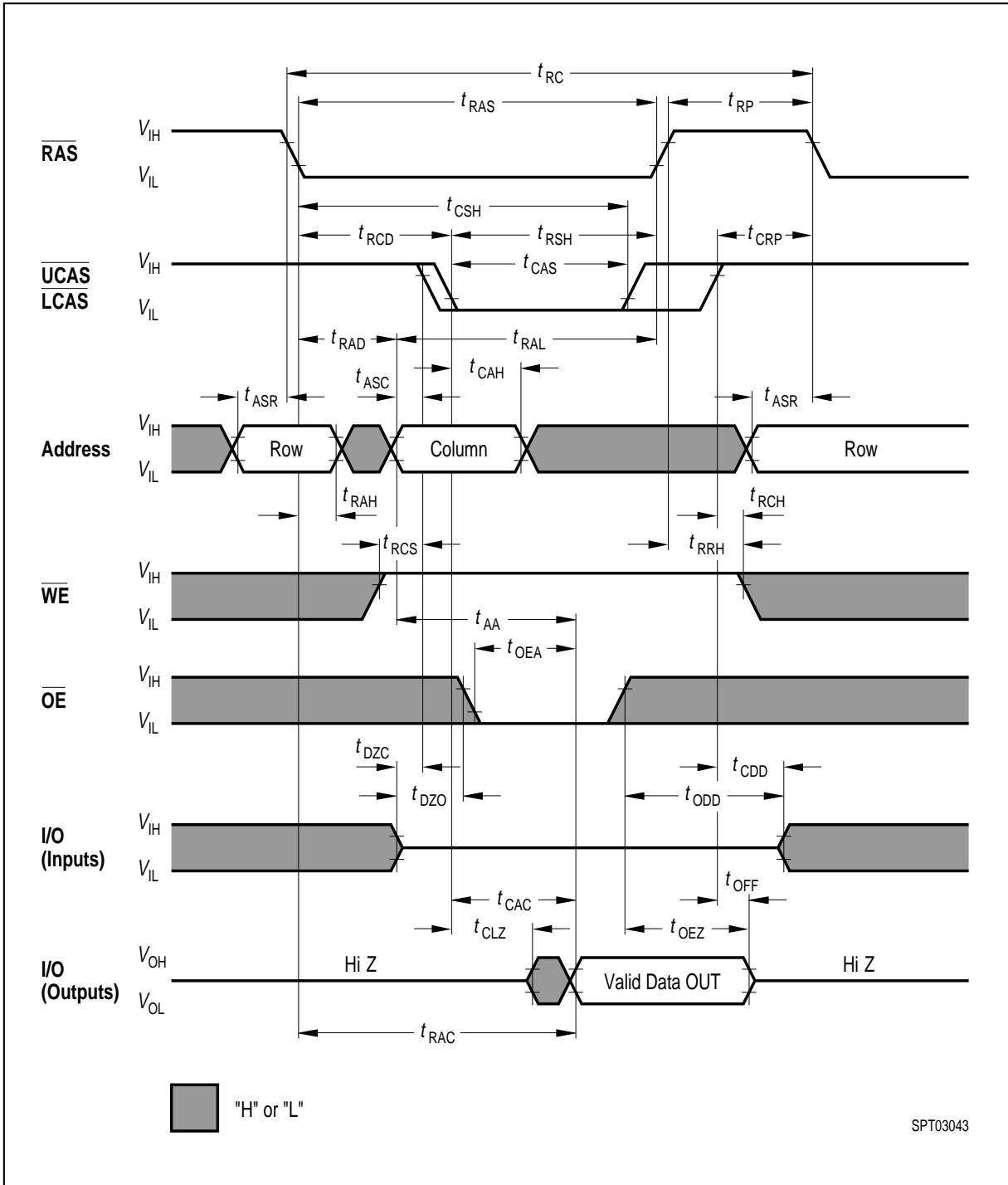
| | | | | | | | | | |
|---|-----------|----|---|----|---|----|---|----|--|
| \overline{CAS} setup time | t_{CSR} | 5 | – | 5 | – | 5 | – | ns | |
| \overline{CAS} hold time | t_{CHR} | 10 | – | 10 | – | 10 | – | ns | |
| \overline{RAS} to \overline{CAS} precharge time | t_{RPC} | 5 | – | 5 | – | 5 | – | ns | |
| Write to \overline{RAS} precharge time | t_{WRP} | 10 | – | 10 | – | 10 | – | ns | |
| Write to \overline{RAS} hold time | t_{WRH} | 10 | – | 10 | – | 10 | – | ns | |

\overline{CAS} -before- \overline{RAS} Counter Test Cycle

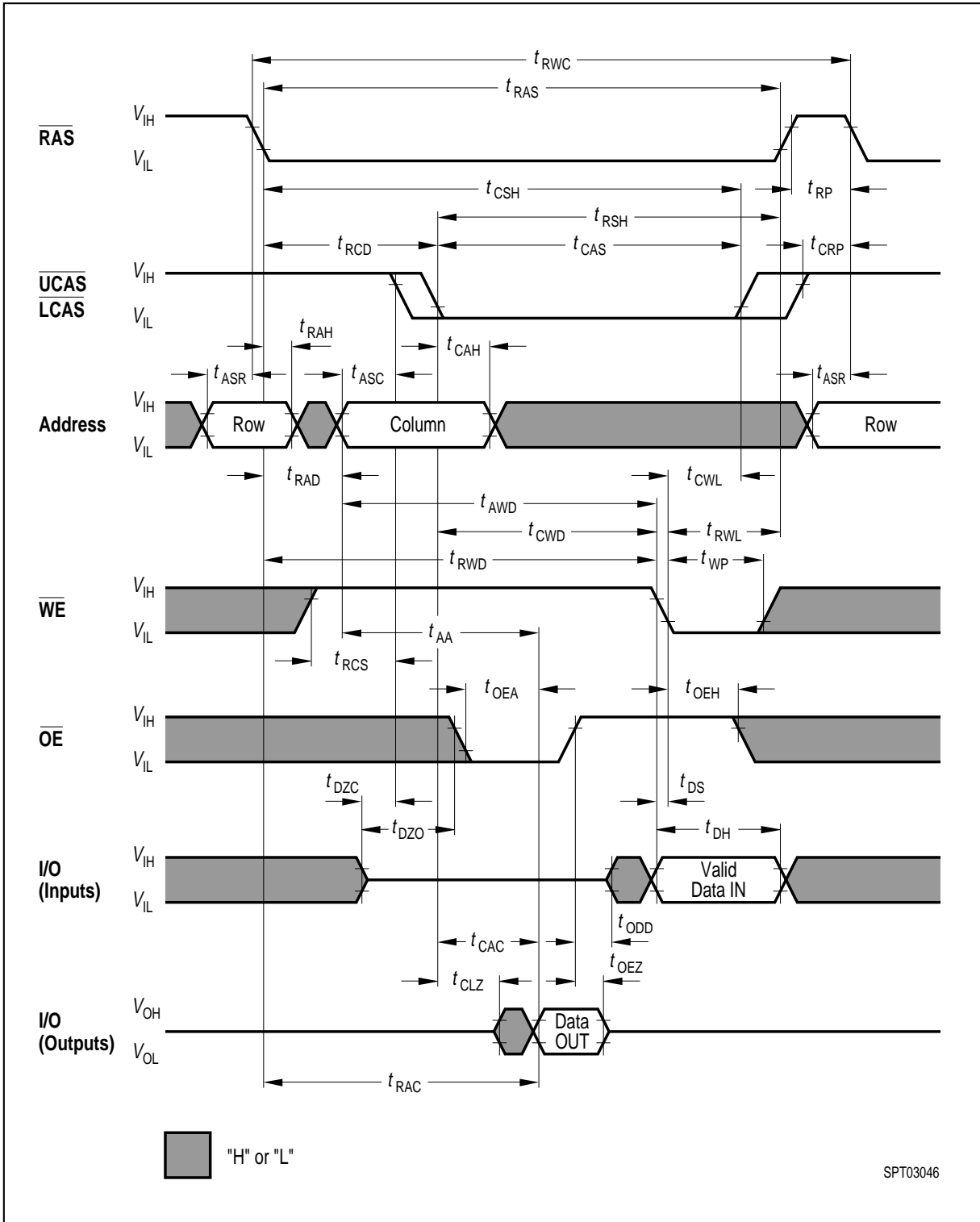
| | | | | | | | | | |
|---------------------------------|-----------|----|---|----|---|----|---|----|--|
| \overline{CAS} precharge time | t_{CPT} | 35 | – | 35 | – | 40 | – | ns | |
|---------------------------------|-----------|----|---|----|---|----|---|----|--|

Notes

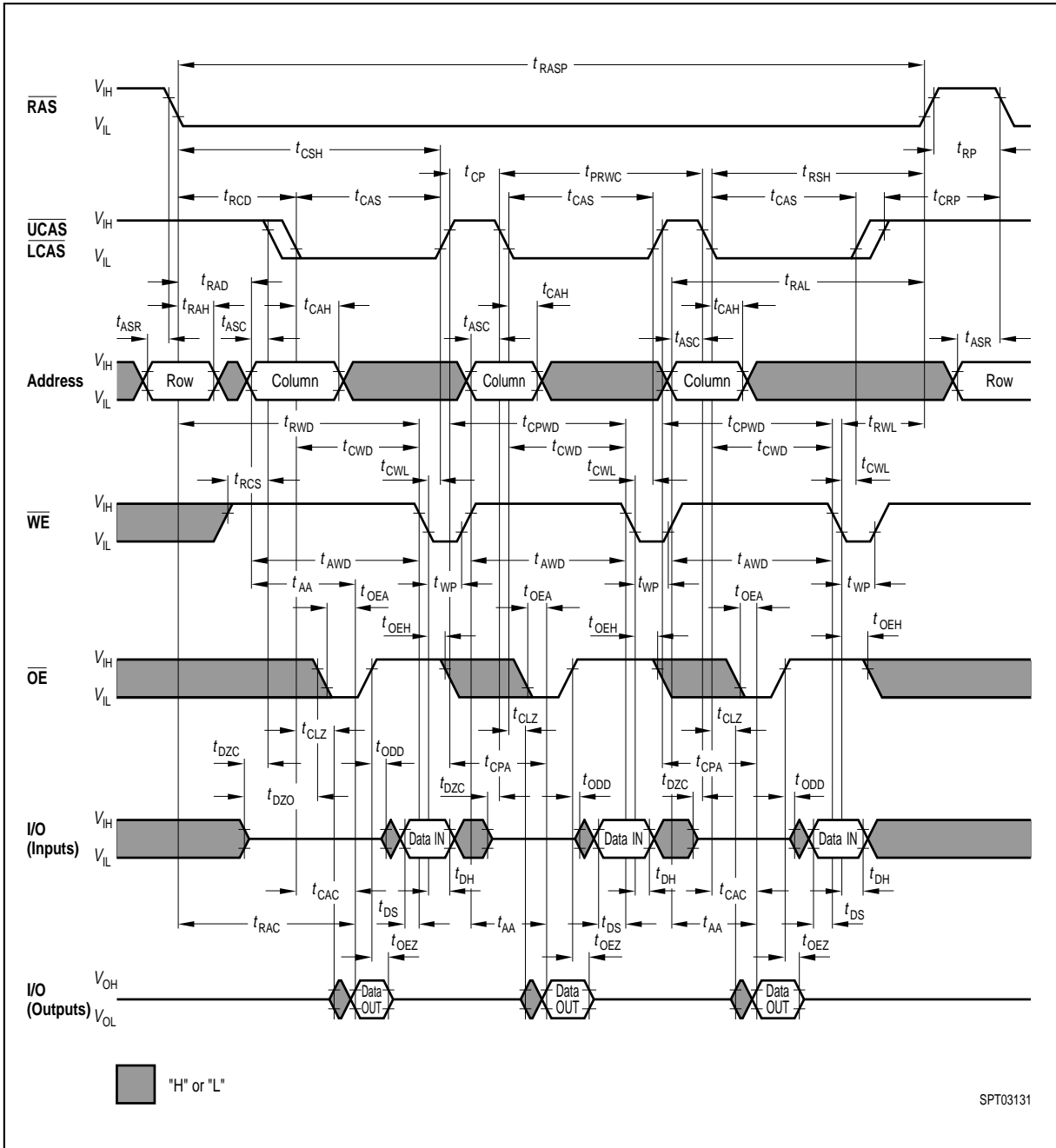
1. All voltages are referenced to V_{SS} .
2. I_{CC1} , I_{CC3} , I_{CC4} and I_{CC6} depend on cycle rate.
3. I_{CC1} and I_{CC4} depend on output loading. Specified values are obtained with the output open.
4. Address can be changed once or less while $\overline{RAS} = V_{IL}$. In case of I_{CC4} it can be changed once or less during a hyper page mode (EDO) cycle
5. An initial pause of 200 μs is required after power-up followed by 8 \overline{RAS} cycles of which at least one cycle has to be a refresh cycle, before proper device operation is achieved. In case of using the internal refresh counter, a minimum of 8 \overline{CAS} -before- \overline{RAS} initialization cycles instead of 8 \overline{RAS} cycles are required.
6. AC measurements assume $t_T = 2$ ns.
7. $V_{IH(MIN)}$ and $V_{IL(MAX)}$ are reference levels for measuring timing of input signals. Transition times are also measured between V_{IH} and V_{IL} .
8. Measured with the specified current load and 100 pF at $V_{OL} = 0.8$ V and $V_{OH} = 2.0$ V. Access time is determined by the latter of t_{RAC} , t_{CAC} , t_{AA} , t_{CPA} , t_{OEA} . t_{CAC} is measured from tristate.
9. Operation within the $t_{RCD(MAX)}$ limit ensures that $t_{RAC(MAX)}$ can be met. $t_{RCD(MAX)}$ is specified as a reference point only. If t_{RCD} is greater than the specified $t_{RCD(MAX)}$ limit, then access time is controlled by t_{CAC} .
10. Operation within the $t_{RAD(MAX)}$ limit ensures that $t_{RAC(MAX)}$ can be met. $t_{RAD(MAX)}$ is specified as a reference point only. If t_{RAD} is greater than the specified $t_{RAD(MAX)}$ limit, then access time is controlled by t_{AA} .
11. Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.
12. $t_{OFF(MAX)}$, $t_{OEZ(MAX)}$ define the time at which the output achieves the open-circuit conditions and are not referenced to output voltage levels. t_{OFF} is referenced from the rising edge of \overline{RAS} or \overline{CAS} , whichever occurs last.
13. Either t_{DZC} or t_{DZO} must be satisfied.
14. Either t_{CDD} or t_{ODD} must be satisfied.
15. t_{WCS} , t_{RWD} , t_{CWD} and t_{AWD} are not restrictive operating parameters. They are included in the data sheet as electrical characteristics only. If $t_{WCS} > t_{WCS(MIN)}$, the cycle is an early write cycle and data out pin will remain open-circuit (high impedance) through the entire cycle; if $t_{RWD} > t_{RWD(MIN)}$, $t_{CWD} > t_{CWD(MIN)}$ and $t_{AWD} > t_{AWD(MIN)}$, the cycle is a read-write cycle and I/O will contain data read from the selected cells. If neither of the above sets of conditions is satisfied, the condition of I/O (at access time) is indeterminated.
16. These parameters are referenced to the \overline{CAS} leading edge in early write cycles and to the \overline{WE} leading edge in read-write cycles.



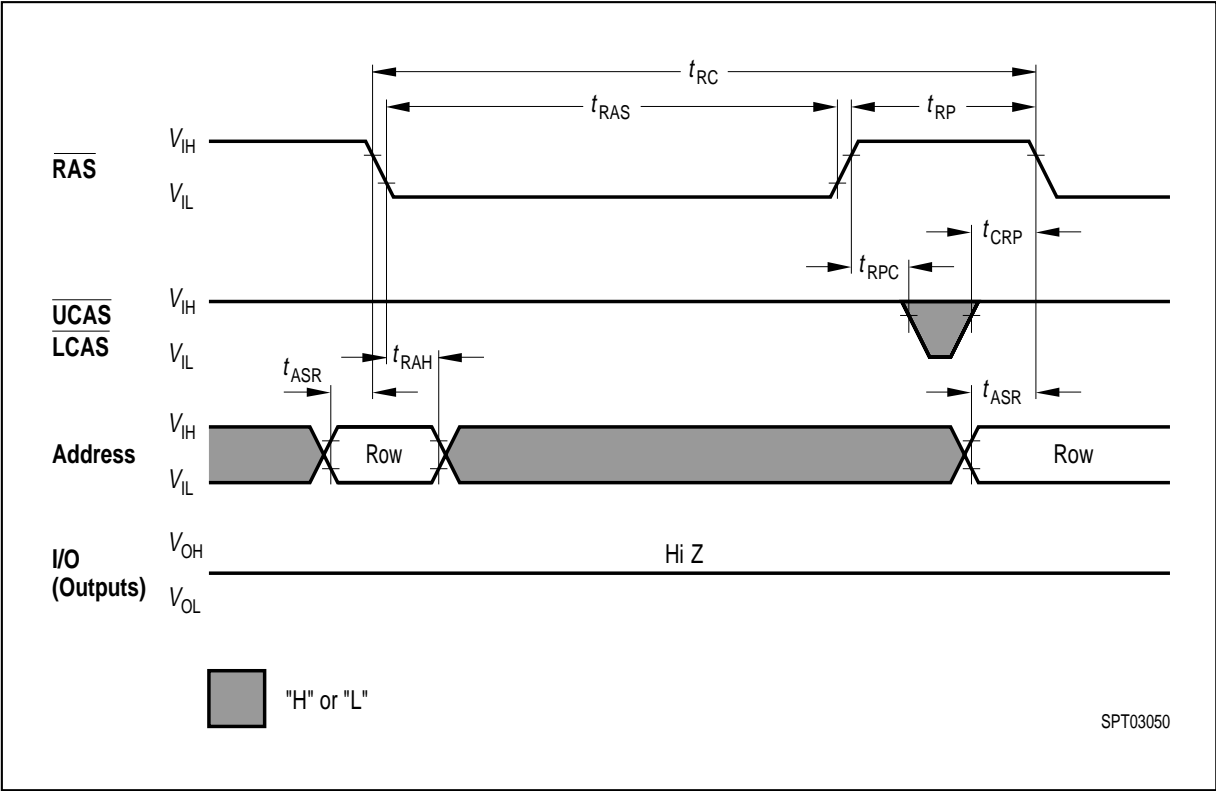
Read Cycle



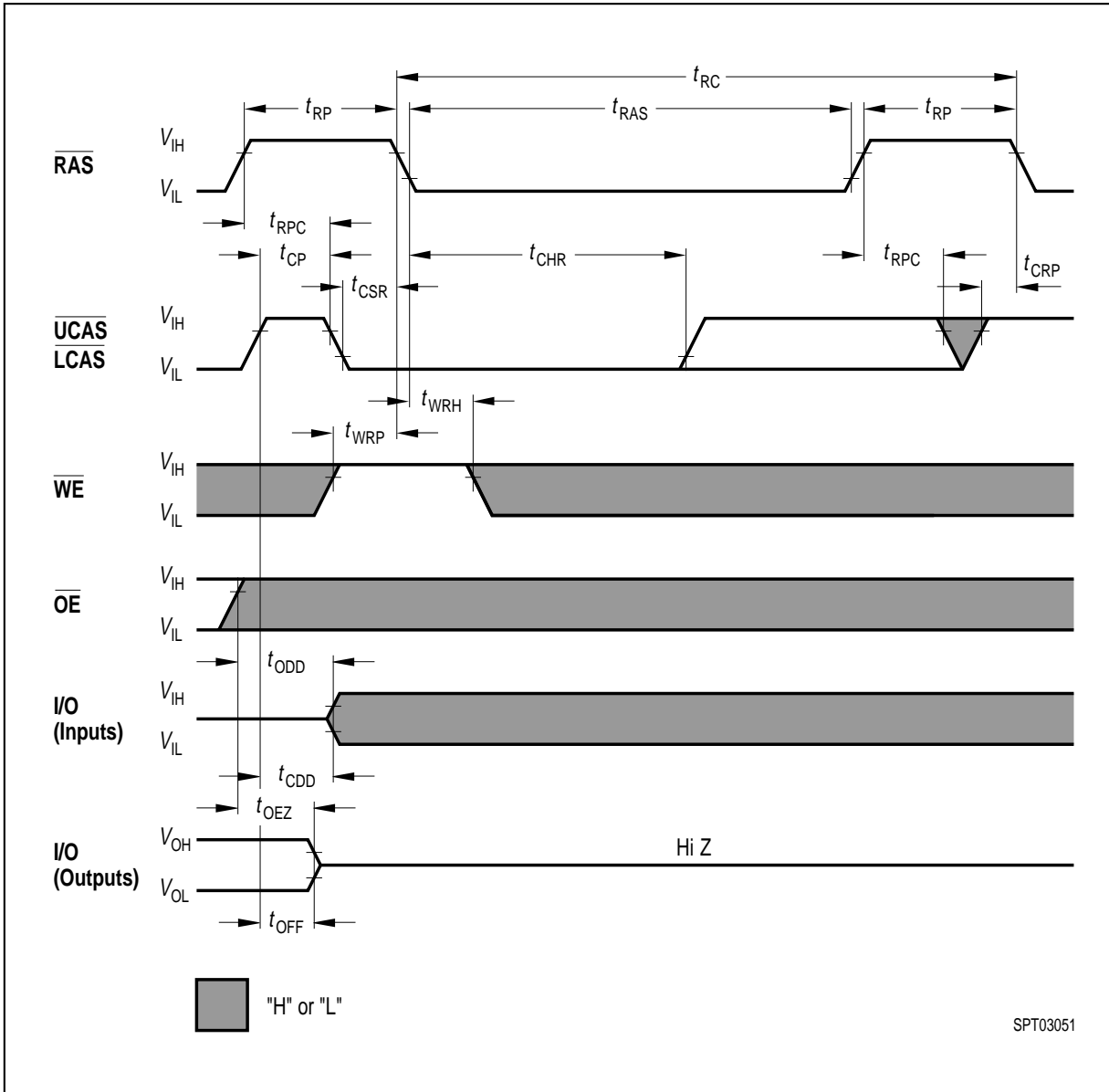
Read-Write (Read-Modify-Write) Cycle



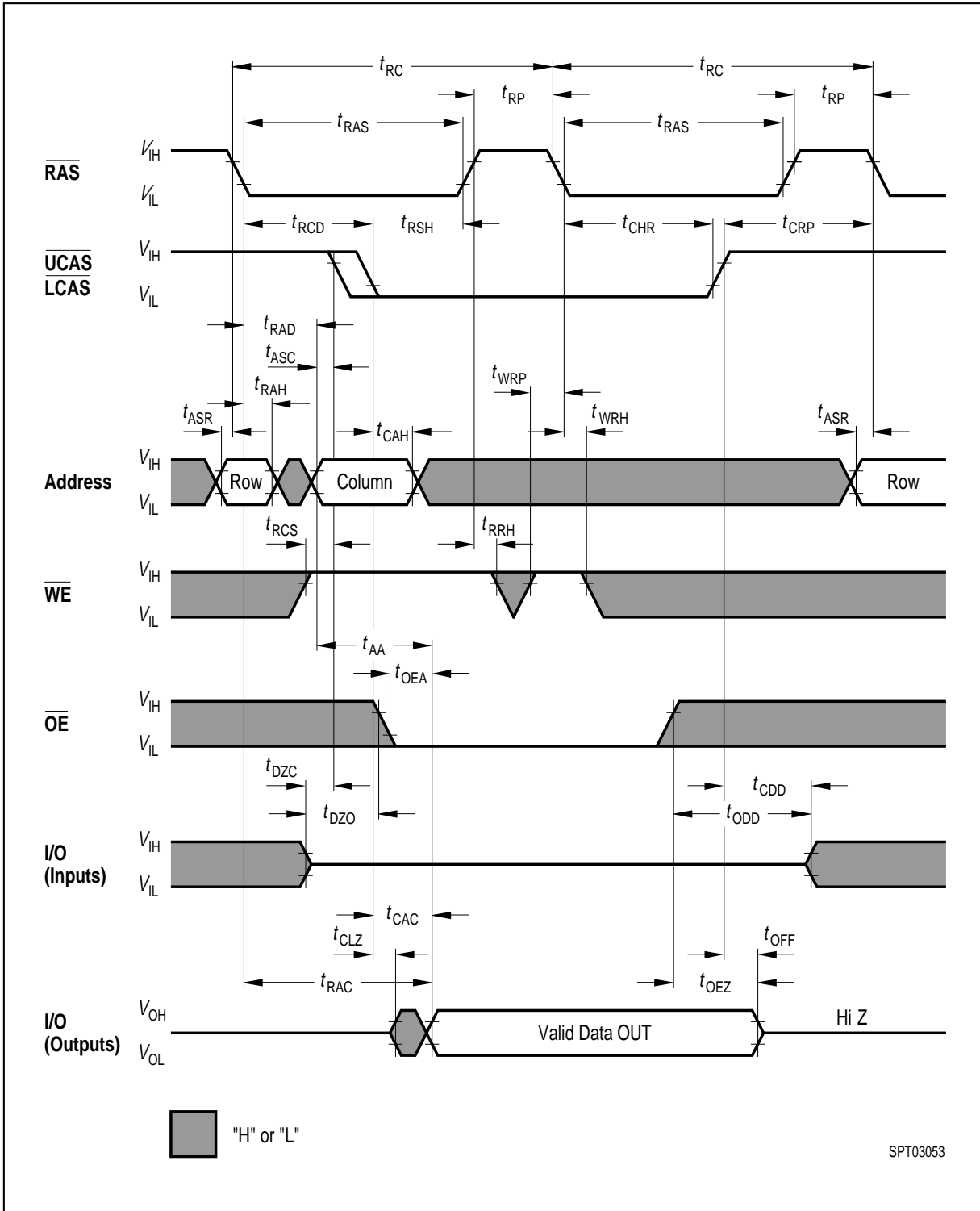
Hyper Page Mode (EDO) Late Write and Read-Modify-Write Cycles



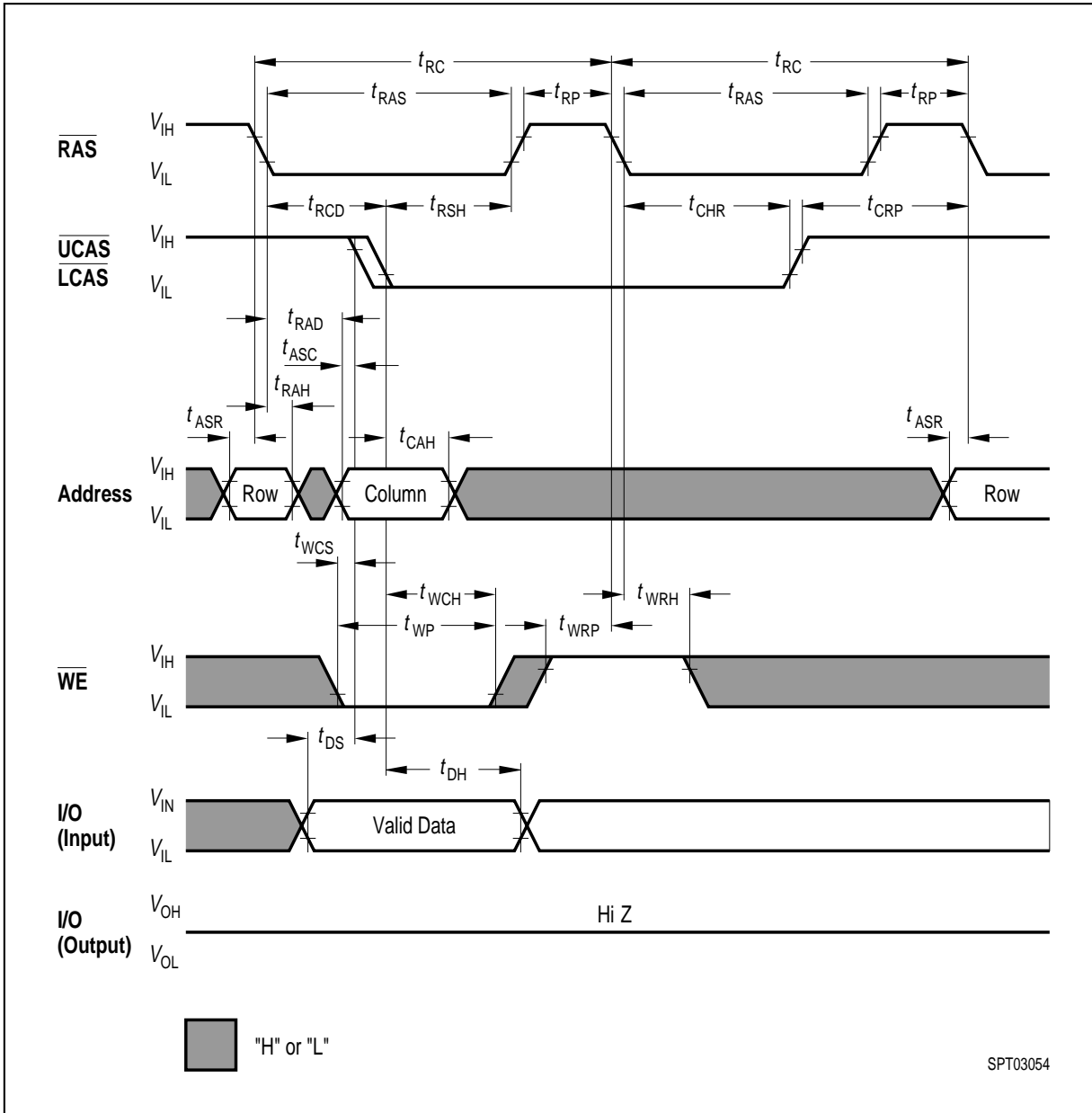
RAS-Only Refresh Cycle



CAS-Before-RAS Refresh Cycle

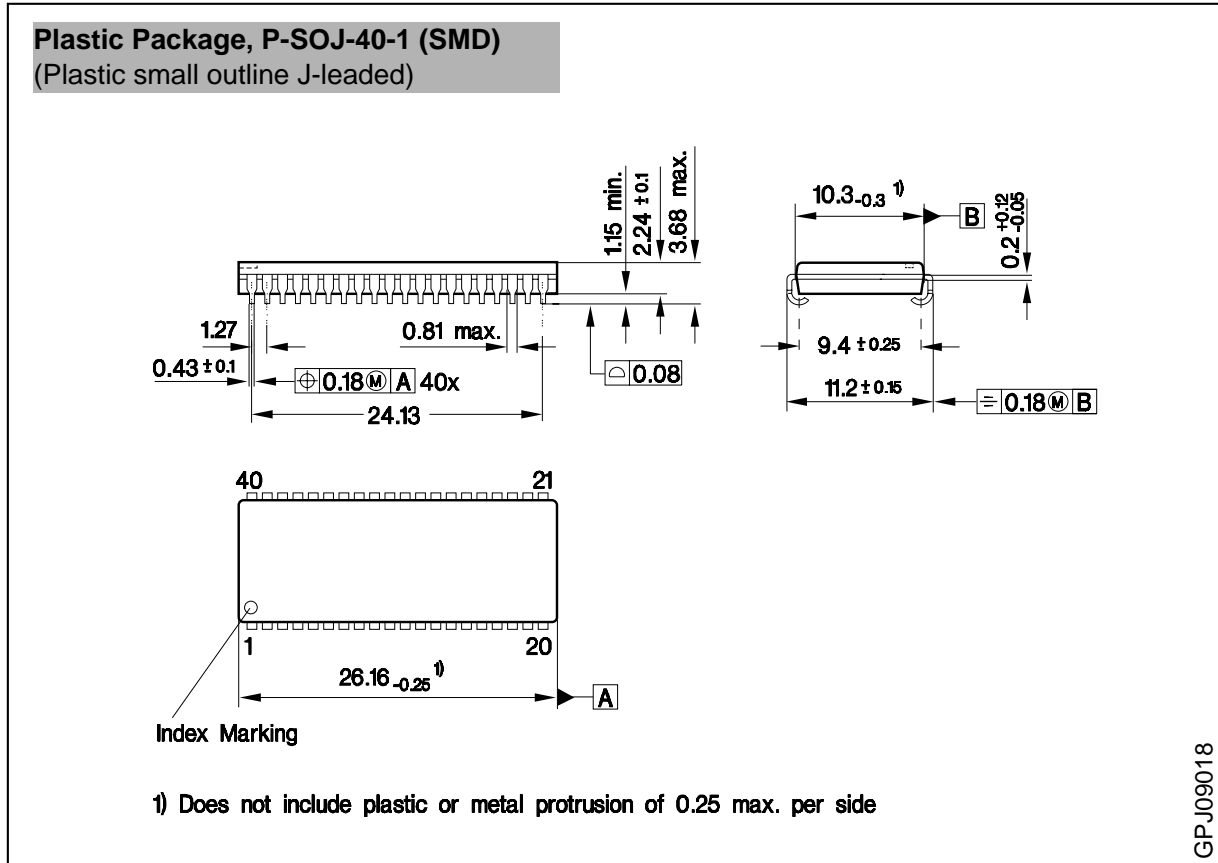


Hidden Refresh Cycle (Read)



Hidden Refresh Cycle (Early Write)

Package Outlines



Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm