

704-313



UM621024C Series

128K X 8 CMOS SRAM

PRELIMINARY

Features

- Single +5V power supply
- Access times: 55/70 ns (max.)
- Current:
 - Low power version: Operating: 70mA (max.)
Standby: 100 μ A (max.)
 - Very low power version: Operating: 70mA (max.)
Standby: 25 μ A (max.)
- Fully static operation, no clock or refreshing required

- Directly TTL compatible: All inputs and outputs
- Common I/O using three-state output
- Output enable and two chip enable inputs for easy application
- Data retention voltage: 2V (min.)
- Available in 32-pin DIP, SOP or TSOP packages

General Description

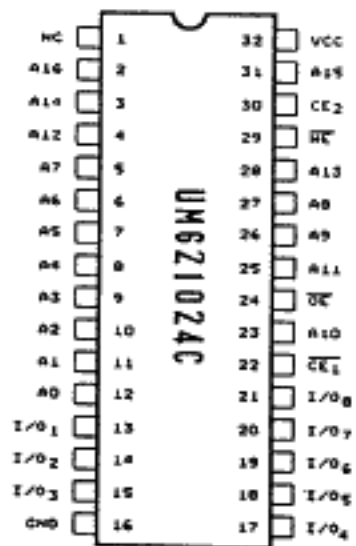
The UM621024C is a low operating current 1,048,576-bit static random access memory organized as 131,072 words by 8 bits and operates on single 5V power supply. It is built using UMC's high performance CMOS process. Inputs and three-state outputs are TTL compatible and allow for direct interfacing with common system bus structures.

Two chip enable inputs are provided for power down and device enable and an output enable input is included for easy interface.

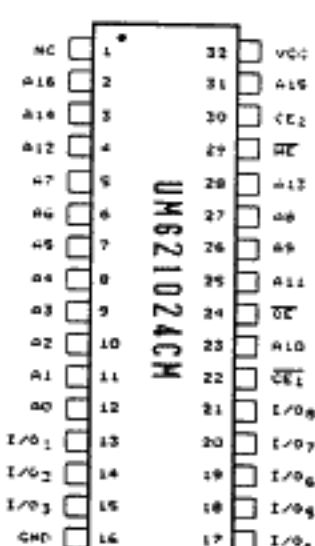
Data retention is guaranteed at a power supply voltage as low as 2V.

Pin Configurations

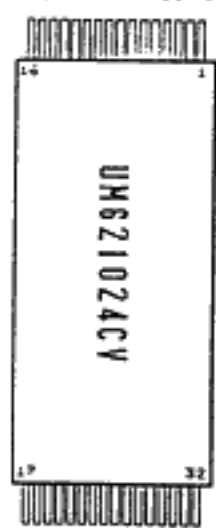
■ DIP



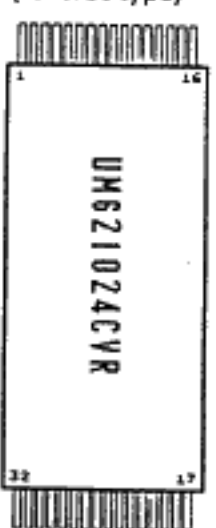
■ SOP



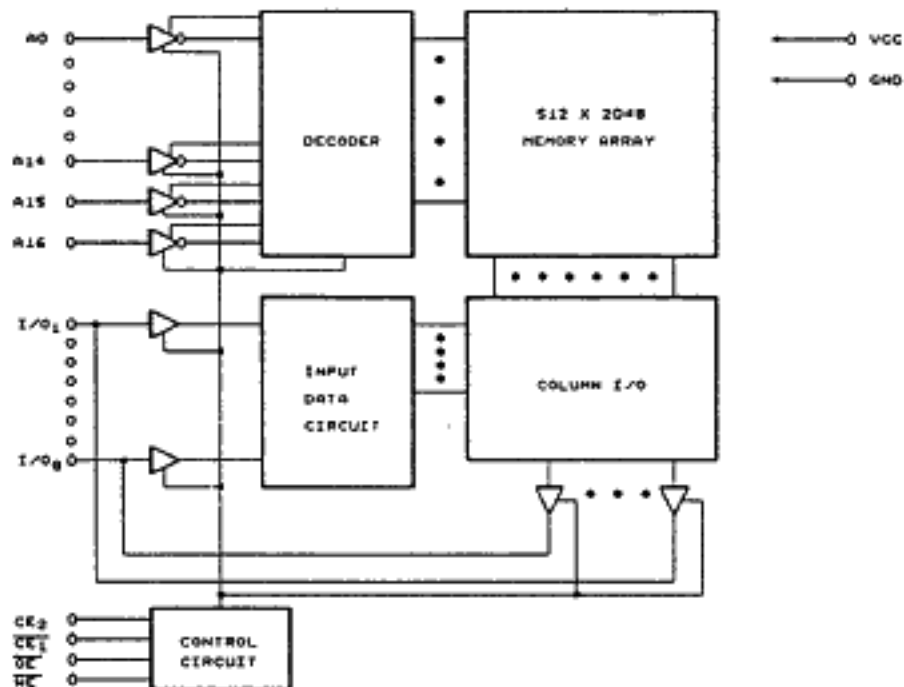
■ TSOP (forward type)



(reverse type)



| | | | | | | | | | | | |
|----------|------|-----|------|------|-----------------|------|------|------------------|-----|-----------------|------|
| Pin No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Pin Name | A11 | A9 | A8 | A13 | \overline{WE} | CE2 | A15 | VCC | NC | A16 | A14 |
| Pin No. | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| Pin Name | A12 | A7 | A6 | A5 | A4 | A3 | A2 | A1 | A0 | I/O* | I/O2 |
| Pin No. | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | |
| Pin Name | I/O1 | GND | I/O4 | I/O5 | I/O6 | I/O7 | I/O8 | $\overline{CE1}$ | A10 | \overline{OE} | |

Block Diagram

Pin Descriptions — DIP/SOP

| Pin No. | Symbol | Description |
|-------------------------|------------------|--------------------|
| 2 - 12, 23, 25 - 28, 31 | A0 - A16 | Address Input |
| 29 | \overline{WE} | Write Enable |
| 24 | \overline{OE} | Output Enable |
| 22 | $\overline{CE1}$ | Chip Enable |
| 30 | CE2 | Chip Enable |
| 1 | NC | No Connection |
| 13-15, 17-21 | I/O1 - I/O8 | Data Input/Output |
| 32 | VCC | Power Supply (+5V) |
| 16 | GND | Ground |

Pin Description — TSOP

| Pin No. | Symbol | Description |
|-----------------------|------------------|-------------------|
| 1 - 4, 7, 10 - 20, 31 | A0 - A16 | Address Input |
| 5 | \overline{WE} | Write Enable |
| 32 | \overline{OE} | Output Enable |
| 30 | $\overline{CE1}$ | Chip Enable |
| 6 | CE2 | Chip Enable |
| 9 | NC | No Connection |
| 21-23, 25-29 | I/O1 - I/O8 | Data Input/Output |
| 8 | VCC | Power Supply |
| 24 | GND | Ground |

Recommended DC Operating Conditions

(TA = 0°C to +70°C)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------------|--------------------|------|------|-----------|------|
| VCC | Supply Voltage | 4.5 | 5.0 | 5.5 | V |
| GND | Ground | 0 | 0 | 0 | V |
| V _{IH} | Input High Voltage | 2.2 | 3.5 | VCC + 0.3 | V |
| V _{IL} | Input Low Voltage | -0.3 | 0 | +0.8 | V |
| C _L | Output Load | - | - | 30 | pF |
| TTL | Output Load | - | - | 1 | - |

Absolute Maximum Ratings*

| | |
|---|---------------------|
| VCC to GND | -0.5V to +7.0V |
| IN, IN/OUT Volt to GND | -0.5V to VCC + 0.5V |
| Operating Temperature, T _{opr} | 0°C to +70°C |
| Storage Temperature, T _{stg} | -55°C to +125°C |
| Temperature Under Bias, T _{bias} | -10°C to +85°C |
| Power Dissipation, P _T | 0.7W |
| Soldering Temp. & Time | 260°C, 10 sec |

***Comments**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied and exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC Electrical Characteristics (TA = 0°C to +70°C, VCC = 5V ± 10%, GND = 0V)

| Symbol | Parameter | UM621024C-55L/70L | | UM621024C-55LL/70LL | | Unit | Conditions |
|-----------------|-----------------------------|-------------------|------|---------------------|------|------|---|
| | | Min. | Max. | Min. | Max. | | |
| I _I | Input Leakage Current | - | 1 | - | 1 | μA | V _{IH} = GND to VCC |
| I _O | Output Leakage Current | - | 1 | - | 1 | μA | $\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$ or $\overline{OE} = V_{IH}$ or $\overline{WE} = V_{IL}$ V _{I/O} = GND to VCC |
| I _{CC} | Active Power Supply Current | - | 15 | - | 15 | mA | $\overline{CE1} = V_{IL}$, $CE2 = V_{IH}$ I _{I/O} = 0 mA |

DC Electrical Characteristics (continued)

| Symbol | Parameter | UM621024C-55L/70L | | UM621024C-55LL/70LL | | Unit | Conditions |
|------------------|------------------------------|-------------------|------|---------------------|------|------|---|
| | | Min. | Max. | Min. | Max. | | |
| I _{CC1} | Dynamic Operating Current | - | 70 | - | 70 | mA | Min. Cycle, Duty = 100% CE ₁ = V _{IL} , CE ₂ = V _{IH} I _{I/O} = 0 mA |
| I _{CC2} | | - | 15 | - | 15 | mA | CE ₁ = V _{IL} , CE ₂ = V _{IH} V _{IH} = V _{CC} , V _{IL} = 0V f = 1 MHz, I _{I/O} = 0 mA |
| I _{S8} | Standby Power Supply Current | - | 3 | - | 2 | mA | CE ₁ = V _{IH} or CE ₂ = V _{IL} |
| I _{S81} | | - | 100 | - | 25 | μA | CE ₁ ≥ V _{CC} - 0.2V CE ₂ ≥ V _{CC} - 0.2V V _{IN} ≥ 0V |
| I _{S82} | | - | 100 | - | 25 | μA | CE ₂ ≤ 0.2V V _{IN} ≥ 0V |
| V _{OL} | Output Low Voltage | - | 0.4 | - | 0.4 | V | I _{OL} = 2.1 mA |
| V _{OH} | Output High Voltage | 2.4 | - | 2.4 | - | V | I _{OH} = -1.0 mA |

Truth Table

| Mode | CE ₁ | CE ₂ | OE | WE | I/O Operation | Supply Current |
|-----------------|-----------------|-----------------|----|----|---------------|---|
| Standby | H | X | X | X | High Z | I _{S8} , I _{S81} |
| | X | L | X | X | High Z | I _{S8} , I _{S82} |
| Output Disabled | L | H | H | H | High Z | I _{CC} , I _{CC1} , I _{CC2} |
| Read | L | H | L | H | DOUT | I _{CC} , I _{CC1} , I _{CC2} |
| Write | L | H | X | L | DIN | I _{CC} , I _{CC1} , I _{CC2} |

Note: X: H or L

Capacitance (T_A = 25°C, f = 1.0 MHz)

| Symbol | Parameter | Min. | Max. | Unit | Conditions |
|--------------------|--------------------------|------|------|------|-----------------------|
| C _{IN} * | Input Capacitance | | 6 | pF | V _{IN} = 0V |
| C _{I/O} * | Input/Output Capacitance | | 8 | pF | V _{I/O} = 0V |

* This parameter is sampled and not 100% tested.

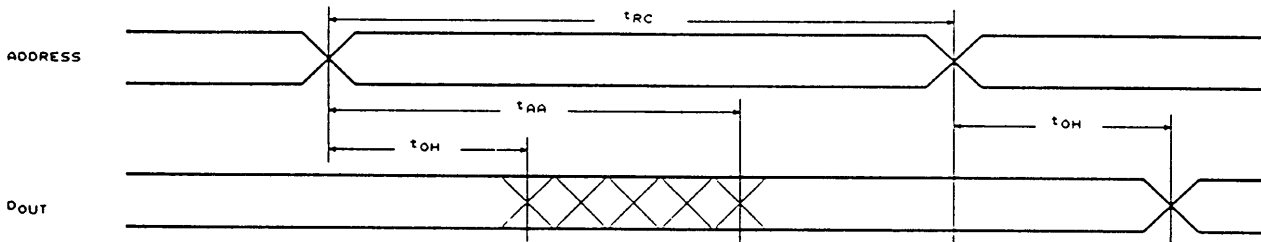
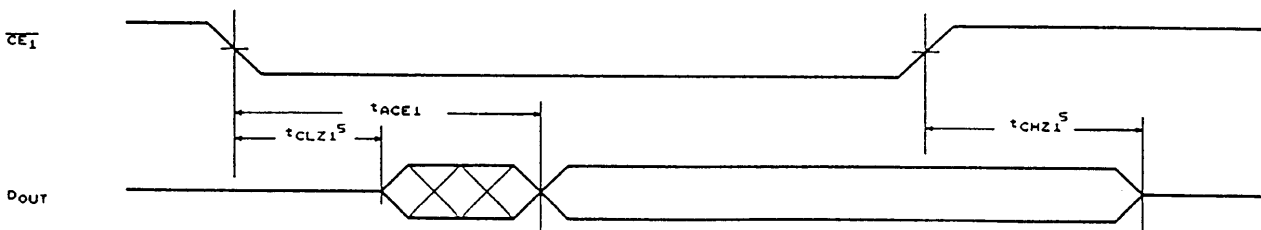
AC Characteristics ($T_A = 0^\circ\text{C to } +70^\circ\text{C}, V_{CC} = 5\text{V} \pm 10\%$)

| Symbol | Parameter | UM621024C-55L/LL | | UM621024C-70L/LL | | Unit | |
|-------------|------------------------------------|------------------|------|------------------|------|------|----|
| | | Min. | Max. | Min. | Max. | | |
| Read Cycle | | | | | | | |
| t_{RC} | Read Cycle Time | 55 | - | 70 | - | ns | |
| t_{AA} | Address Access Time | - | 55 | - | 70 | ns | |
| t_{ACE1} | Chip Enable Access Time | $\overline{CE1}$ | - | 55 | - | 70 | ns |
| t_{ACE2} | | CE2 | - | 55 | - | 70 | ns |
| t_{OE} | Output Enable to Output Valid | - | 30 | - | 35 | ns | |
| t_{CLZ1} | Chip Enable to Output in Low Z | $\overline{CE1}$ | 10 | - | 10 | - | ns |
| t_{CLZ2} | | CE2 | 10 | - | 10 | - | ns |
| t_{OLZ} | Output Enable to Output in Low Z | 5 | - | 5 | - | ns | |
| t_{CHZ1} | Chip Disable to Output in High Z | $\overline{CE1}$ | 0 | 20 | 0 | 25 | ns |
| t_{CHZ2} | | CE2 | 0 | 20 | 0 | 25 | ns |
| t_{OHZ} | Output Disable to Output in High Z | 0 | 20 | 0 | 25 | ns | |
| t_{OH} | Output Hold from Address Change | 5 | - | 5 | - | ns | |
| Write Cycle | | | | | | | |
| t_{WC} | Write Cycle Time | 55 | - | 70 | - | ns | |
| t_{CW} | Chip Enable to End of Write | 50 | - | 60 | - | ns | |
| t_{AS} | Address Setup Time | 0 | - | 0 | - | ns | |
| t_{AW} | Address Valid to End of Write | 50 | - | 60 | - | ns | |

AC Characteristics (continued)

| Symbol | Parameter | UM621024C-55L/LL | | UM621024C-70L/LL | | Unit |
|-----------|---------------------------------|------------------|------|------------------|------|------|
| | | Min. | Max. | Min. | Max. | |
| t_{WP} | Write Pulse Width | 40 | - | 50 | - | ns |
| t_{WR} | Write Recovery Time | 0 | - | 0 | - | ns |
| t_{WHZ} | Write to Output in High Z | 0 | 25 | 0 | 30 | ns |
| t_{DW} | Data to Write Time Overlap | 25 | - | 30 | - | ns |
| t_{DH} | Data Hold from Write Time | 0 | - | 0 | - | ns |
| t_{OW} | Output Active from End of Write | 5 | - | 5 | - | ns |

Notes: t_{CHZ1} , t_{CHZ2} and t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit condition and are not referred to output voltage levels.

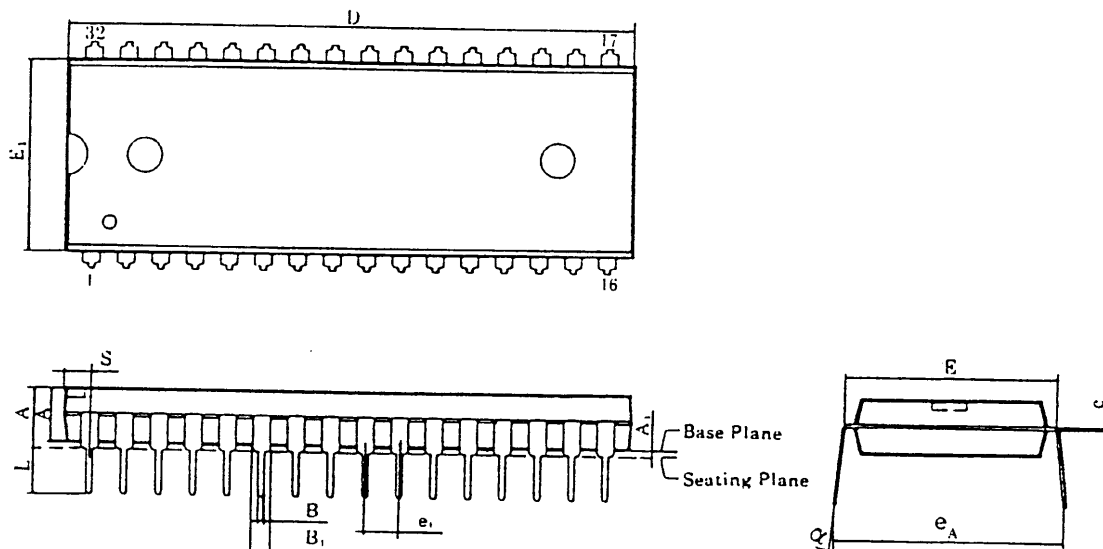
Timing Waveforms
Read Cycle 1¹ (1, 2, 4)

Read Cycle 2¹ (1, 3, 4, 6)


Ordering Information

| Part No. | Access Time (ns) | Operating Current Max. (mA) | Standby Current Max. (μ A) | Package | |
|------------------|------------------|-----------------------------|----------------------------------|----------|---------|
| UM621024C-70L | 70 | 70 | 100 | 32L DIP | |
| UM621024C-70LL | | 70 | 25 | 32L DIP | |
| UM621024CM-70L | | 70 | 100 | 32L SOP | |
| UM621024CM-70LL | | 70 | 25 | 32L SOP | |
| UM621024CV-70L | | 70 | 100 | 32L TSOP | |
| UM621024CV-70LL | | 70 | 25 | 32L TSOP | |
| UM621024CVR-70L | | 70 | 100 | 32L TSOP | |
| UM621024CVR-70LL | | 70 | 25 | 32L TSOP | |
| UM621024C-10L | | 100 | 70 | 100 | 32L DIP |
| UM621024C-10LL | | | 70 | 25 | 32L DIP |
| UM621024CM-10L | 70 | | 100 | 32L SOP | |
| UM621024CM-10LL | 70 | | 25 | 32L SOP | |
| UM621024CV-10L | 70 | | 100 | 32L TSOP | |
| UM621024CV-10LL | 70 | | 25 | 32L TSOP | |
| UM621024CVR-10L | 70 | | 100 | 32L TSOP | |
| UM621024CVR-10LL | 70 | | 25 | 32L TSOP | |

Package Information
DIP 32L Outline Dimensions

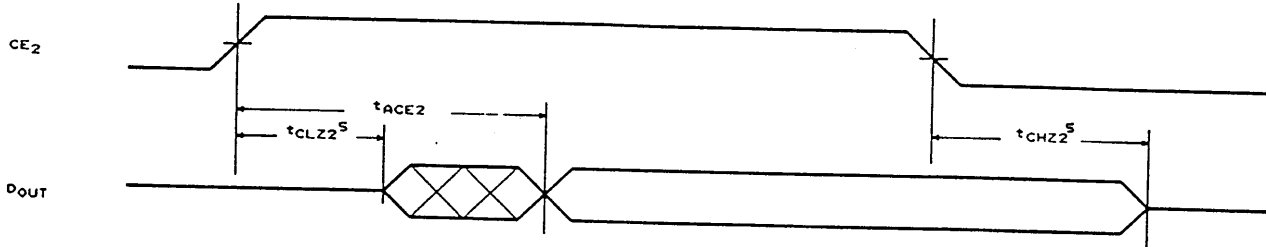
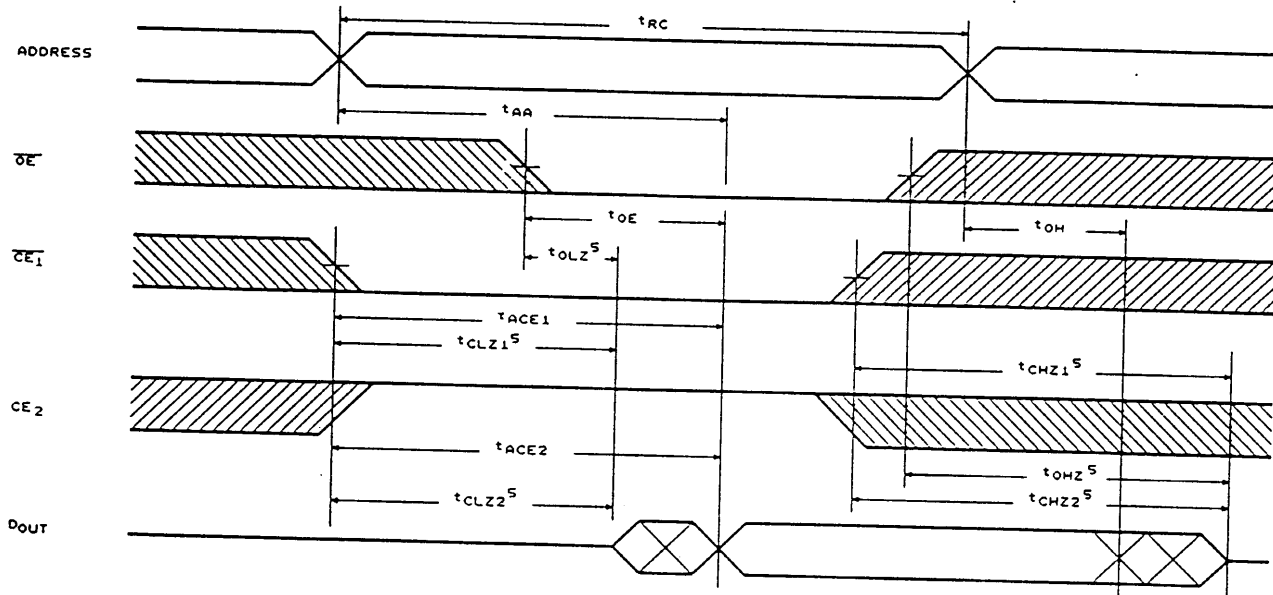
Unit: inches/mm



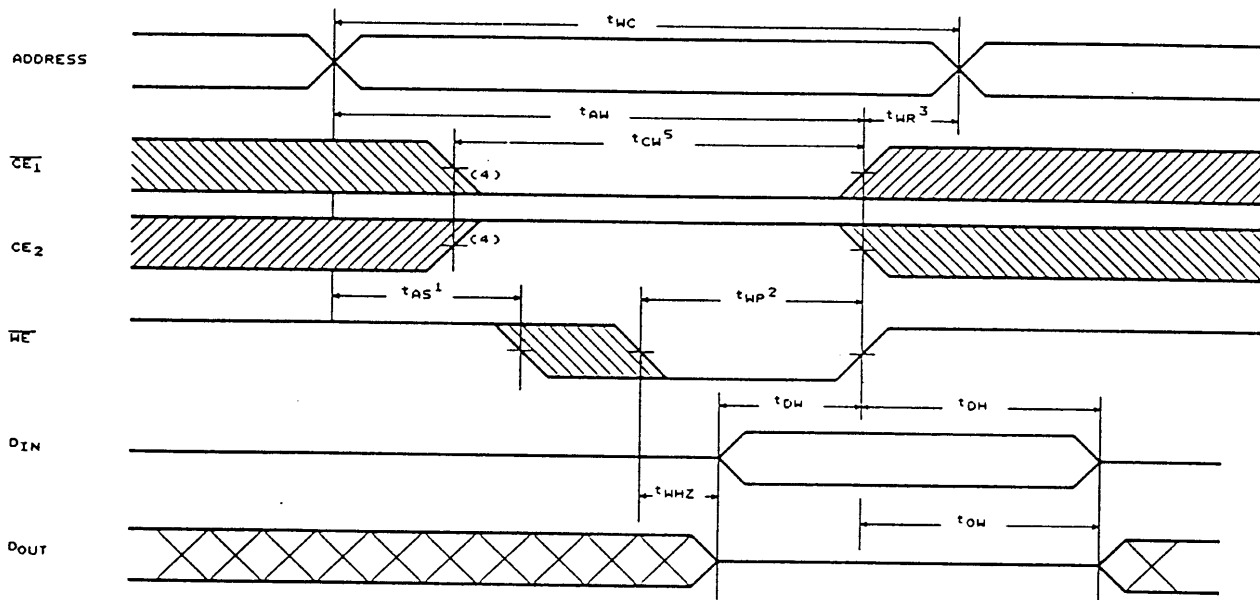
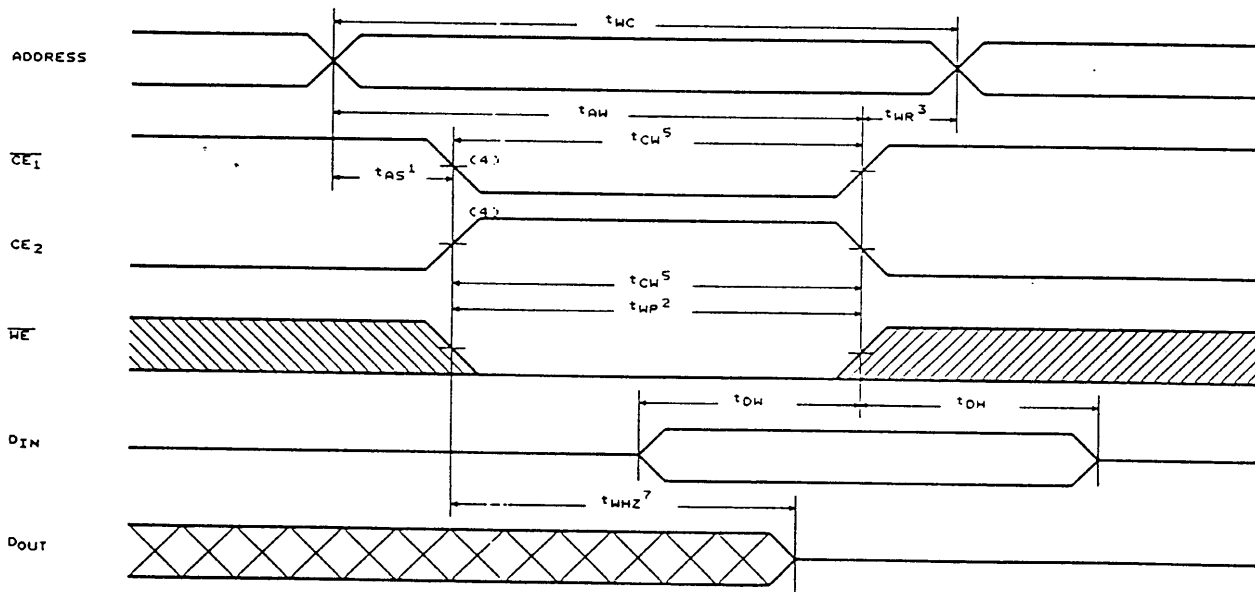
| Symbol | Dimensions in inches | Dimensions in mm |
|----------------|-----------------------------------|--------------------------------|
| A | 0.210 Max. | 5.33 Max. |
| A ₁ | 0.010 Min. | 0.25 Min. |
| A ₂ | 0.155±0.010 | 3.94±0.25 |
| B | 0.018 ^{+0.004} -0.002 | 0.46 ^{+0.10} -0.05 |
| B ₁ | 0.050 ^{+0.004} -0.002 | 1.27 ^{+0.10} -0.05 |
| C | 0.010 ^{+0.004} -0.002 | 0.25 ^{+0.10} -0.05 |
| D | 1.650 Typ. (1.670 Max.) | 41.91 Typ. (42.42 Max.) |
| E | 0.600±0.010 | 15.24±0.25 |
| E ₁ | 0.550 Typ. (0.562 Max.) | 13.97 Typ. (14.27 Max.) |
| e ₁ | 0.100±0.010 | 2.54±0.25 |
| L | 0.130±0.010 | 3.30±0.25 |
| α | 0°-15° | 0°-15° |
| e _A | 0.655±0.035 | 16.64±0.89 |
| S | 0.090 Max. | 2.29 Max. |

Notes:

1. The maximum value of dimension D includes end flash.
2. Dimension E₁ does not include resin fins.
3. Dimension S includes end flash.

Timing Waveforms (continued)
Read Cycle 3^(1, 4, 7, 8)

Read Cycle 4⁽¹⁾


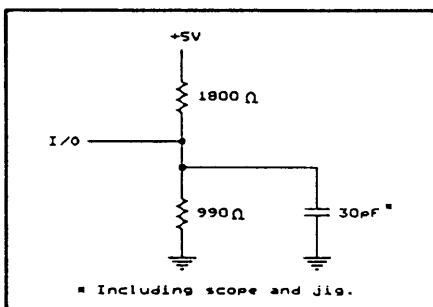
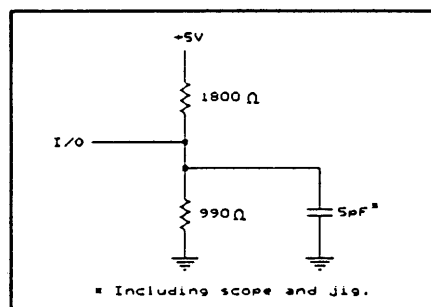
- Notes:
1. \overline{WE} is high for Read Cycle.
 2. Device is continuously enabled $\overline{CE1} = V_{IL}$ and $\overline{CE2} = V_{IH}$.
 3. Address valid prior to or coincident with $\overline{CE1}$ transition low.
 4. $\overline{OE} = V_{IL}$.
 5. Transition is measured $\pm 500\text{mV}$ from steady state. This parameter is sampled and not 100% tested.
 6. $\overline{CE2}$ is high.
 7. $\overline{CE1}$ is low.
 8. Address valid prior to or coincident with $\overline{CE2}$ transition high.

Timing Waveforms (continued)
Write Cycle 1 ⁽⁶⁾
(Write Enable Controlled)

Write Cycle 2
(Chip Enable Controlled)


- Notes:
1. t_{AS} is measured from the address valid to the beginning of write.
 2. A write occurs during the overlap (t_{WP}) of a low $\overline{CE1}$, a high $CE2$ and a low \overline{WE} .
 3. t_{WR} is measured from the earliest of $\overline{CE1}$ or \overline{WE} going high or $CE2$ going low to the end of write cycle.
 4. If the $\overline{CE1}$ low transition or the $CE2$ high transition occurs simultaneously with the \overline{WE} low transition or after the \overline{WE} transition, outputs remain in a high impedance state.
 5. t_{CW} is measured from the later of $\overline{CE1}$ going low or $CE2$ going high to the end of write.
 6. \overline{OE} is continuously low. ($\overline{OE} = V_{IL}$)
 7. Transition is measured $\pm 500\text{mV}$ from steady state. This parameter is sampled and not 100% tested.

AC Test Conditions

| | |
|--|---------------|
| Input Pulse Levels | 0V to 3.0V |
| Input Rise and Fall Time | 5 ns |
| Input and Output Timing Reference Levels | 1.5V |
| Output Load | See Fig. 1, 2 |

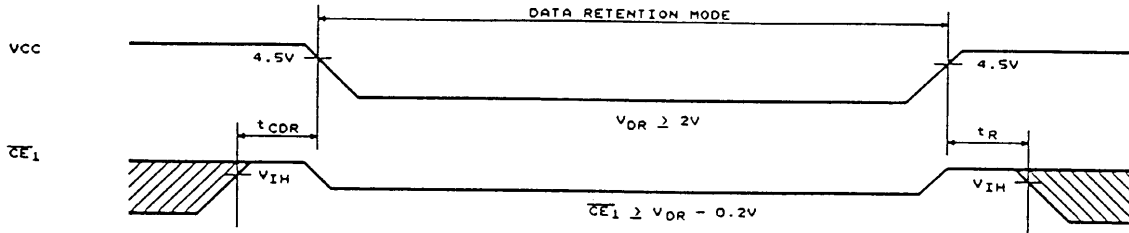
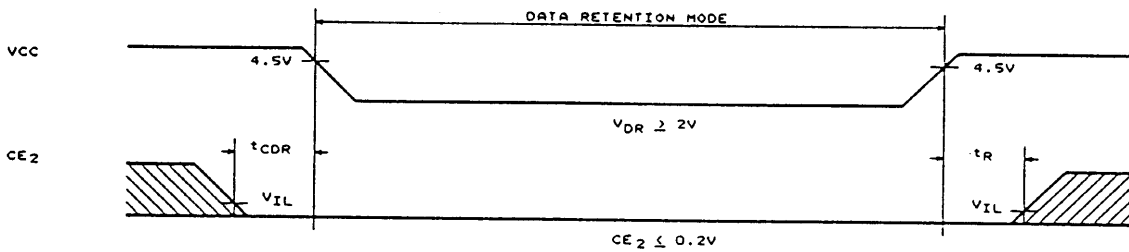

Figure 1. Output Load

**Figure 2. Output Load for t_{CLZ1} , t_{CLZ2} ,
 t_{OLZ} , t_{CHZ1} , t_{CHZ2} ,
 t_{OHZ} , t_{WHZ} , and t_{OW}**
Data Retention Characteristics ($T_A = 0^\circ\text{C}$ to 70°C)

| Symbol | Parameter | Min. | Max. | Unit | Conditions | |
|-----------|-------------------------------------|------------|------|------------------|---|--|
| VDR1 | VCC for Data Retention | 2.0 | 5.5 | V | $\overline{CE1} \geq VCC - 0.2V$ | |
| VDR2 | | 2.0 | 5.5 | V | $\overline{CE2} \leq 0.2V$ $\overline{CE1} \geq VCC - 0.2V$ or $\overline{CE1} \leq 0.2V$ | |
| ICCDR1 | Data Retention Current | L-Version | - | 50 [*] | μA | VCC = 3.0V $\overline{CE1} \geq VCC - 0.2V$ $\overline{CE2} \geq VCC - 0.2V$ $V_{IN} \geq 0V$ |
| | | LL-Version | - | 10 ^{**} | | |
| ICCDR2 | Data Retention Current | L-Version | - | 50 [*] | μA | VCC = 3.0V $\overline{CE2} \leq 0.2V$ $V_{IN} \geq 0V$ |
| | | LL-Version | - | 10 ^{**} | | |
| t_{CDR} | Chip Disable to Data Retention Time | 0 | - | ns | See Retention Waveform | |
| t_R | Operation Recovery Time | 5 | - | ms | | |

****** UM621024C-70LL/10LL

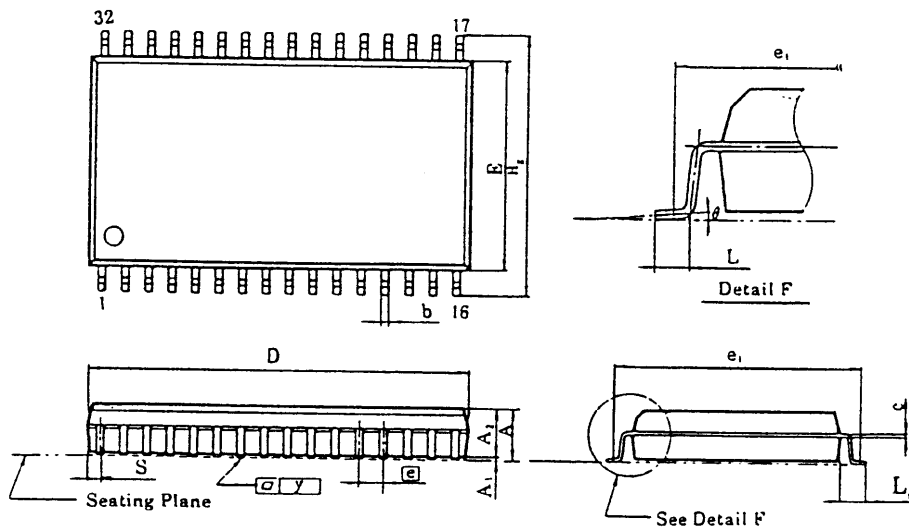
 ICCDR: Max. 3 μA at $T_A = 0^\circ\text{C}$ to $+40^\circ\text{C}$
***** UM621024C-70L/10L

 ICCDR: Max. 20 μA at $T_A = 0^\circ\text{C}$ to $+40^\circ\text{C}$

Low VCC Data Retention Waveform (1) (\overline{CE}_1 Controlled)

Low VCC Data Retention Waveform (2) (CE_2 Controlled)


Package Information
SOP 32L Outline Dimensions

Unit: inches/mm



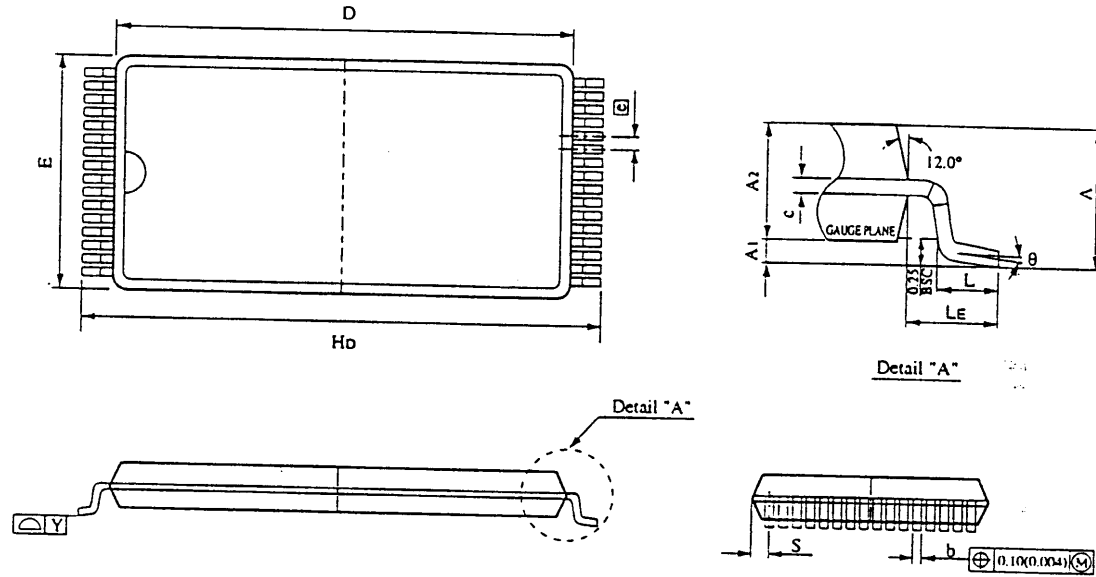
| Symbol | Dimensions in inches | Dimensions in mm |
|---|---|--|
| A | 0.118 Max. | 3.00 Max. |
| A ₁ | 0.004 Min. | 0.10 Min. |
| A ₂ | 0.106±0.005 | 2.69±0.13 |
| b | 0.016 ^{+0.004} _{-0.002} | 0.41 ^{+0.10} _{-0.05} |
| C | 0.008 ^{+0.004} _{-0.002} | 0.20 ^{+0.10} _{-0.05} |
| D | 0.805 Typ. (0.820 Max.) | 20.45 Typ. (20.83 Max.) |
| E | 0.445±0.010 | 11.30±0.25 |
| E | 0.050±0.006 | 1.27±0.15 |
| e ₁ | 0.525 NOM. | 13.34 NOM. |
| H _E | 0.556±0.010 | 14.12±0.25 |
| L | 0.031±0.008 | 0.79±0.20 |
| L _ε | 0.055±0.008 | 1.40±0.20 |
| S | 0.044 Max. | 1.12 Max. |
| y | 0.004 Max. | 0.10 Max. |
| θ | 0°-10° | 0°-10° |

Notes:

1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.
3. Dimension e₁ is for PC Board surface mount pad pitch design reference only.
4. Dimension S includes end flash.

Package Information
TSOP 32L Outline Dimensions

Unit: inches/mm



| Symbol | Dimensions in inches | Dimensions in mm |
|----------------|----------------------|------------------|
| A | 0.047 Max. | 1.20 Max. |
| A ₁ | 0.004±0.002 | 0.10±0.05 |
| A ₂ | 0.039±0.002 | 1.00±0.05 |
| b | 0.008±0.001 | 0.20±0.03 |
| c | 0.006±0.001 | 0.15±0.02 |
| D | 0.724±0.004 | 18.40±0.10 |
| E | 0.315±0.004 | 8.00±0.10 |
| e | 0.020 TYP. | 0.50 TYP. |
| Ho | 0.787±0.007 | 20.00±0.20 |
| L | 0.020±0.004 | 0.50±0.10 |
| LE | 0.031 TYP. | 0.80 TYP. |
| S | 0.0167 TYP. | 0.425 TYP. |
| Y | 0.004 Max. | 0.10 Max. |
| θ | 0° - 6° | 0° - 6° |

Notes:

1. The maximum value of dimension D includes end flash.
2. Dimension E does not include resin fins.
3. Dimension e1 is for PC Board surface mount pad pitch design reference only.
4. Dimension S includes end flash.

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(Revision: November 1994)

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- 2) Title to the goods and the entire risk will pass to Buyer upon delivery to carrier.
- 3) Shipments are subject to availability. UMC shall make every reasonable effort to meet the date(s) quoted or acknowledged; and if UMC makes such effort, UMC will not be liable for any delays.

TERMS OF PAYMENT

- 1) Terms are as stated on UMC's quotation, or if none are stated, Letter of Credit at sight. Accounts past due will incur a monthly charge at the rate of one and one-half percent (1.5%) per month (or, if less, the maximum allowed by applicable law) to cover servicing costs.
- 2) UMC reserves the right to change credit terms at any time in its sole discretion.

LIMITED WARRANTY

UMC warrants that the goods sold will be free from defects in material and workmanship and comply with UMC's applicable published specifications for a period of sixty (60) days from date of UMC's shipment. Goods or parts which have been subject to abuse, misuse, accident, alteration, neglect, or unauthorized repair or improper application are not covered by any warranty. No warranty is made with respect to custom products or goods produced to Buyer's specifications (unless specifically stated in a writing signed by UMC). No warranty is made with respect to goods used in devices intended for use in applications where failure to perform when properly used can reasonably be expected to result in significant injury (including, without limitation, navigation, aviation or nuclear equipment, or for surgical implant or to support or sustain life) and Buyer agrees to indemnify, defend, and hold harmless UMC from all claims, damages and liabilities arising out of any such uses. This Paragraph 4 is the only warranty by UMC with respect to goods and may not be modified or amended except in writing signed by an authorized officer of UMC and by Buyer.

Buyer acknowledges and agrees that it is not relying on any applications or circuits in product literature, and Buyer will test all parts and applications under extended field and laboratory conditions. Notwithstanding any cross-reference or any statements of compatibility, functionality, and the like, UMC's goods may differ from those of others with respect to performance, function and/or operation, with respect to areas not expressly stated in written specifications for UMC's goods, and with respect to ranges outside those specifications; and Buyer agrees that UMC makes no warranties and is not responsible for such things.

EXCEPT AS PROVIDED ABOVE, UMC MAKES NO WARRANTIES OR CONDITIONS, EXPRESS, IMPLIED, OR STATUTORY, AND EXPRESSLY EXCLUDES AND DISCLAIMS ANY WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR APPLICATION.

UMC has no sales or service functions in the U.S.A. and therefore does not intend to sell, and does not imply that it licenses sale of its products in or to the U.S.A.

LIMITATION OF LIABILITY

UMC will not be liable for any loss, damage or penalty resulting from causes beyond its reasonable control, including but not limited to delay by others, force majeure, act of God, or labor conditions. In any such event, the date(s) for UMC's performance will be deemed extended for a period equal to any delay resulting. UMC'S LIABILITY ARISING OUT OF THIS CONTRACT OR ANY GOODS SOLD

WILL BE LIMITED TO REFUND OF THE PURCHASE PRICE OR REPAIR OR REPLACEMENT OF PURCHASED GOODS (RETURNED TO UMC FREIGHT PRE-PAID).

- (c) Buyer will not return any goods without first obtaining a customer return order number.
- (d) AS A SEPARATE LIMITATION, IN NO EVENT WILL UMC BE LIABLE FOR COSTS OF SUBSTITUTE GOODS; FOR ANY SPECIAL, CONSEQUENTIAL, INCIDENTAL OR INDIRECT DAMAGES; OR LOSS OF USE, OPPORTUNITY, MARKET POTENTIAL, AND/OR PROFIT ON ANY THEORY (CONTRACT, TORT, FROM THIRD PARTY CLAIMS OR OTHERWISE). THESE LIMITATIONS SHALL APPLY NOTWITHSTANDING ANY FAILURE OF ESSENTIAL PURPOSE OF ANY REMEDY.
- (e) No action against UMC, whether for breach, indemnification, contribution or otherwise, shall be commenced more than one year after the cause of action has accrued, or more than one year after either the Buyer, user or other person knew or with reasonable diligence should have known of the matter or of any claim of dissatisfaction or defect involved; and no such claim may be brought unless UMC has first been given commercially reasonable notice, a full written explanation of all pertinent details, and a good faith opportunity to resolve the matter.
- (f) BUYER EXPRESSLY AGREES TO THE LIMITATIONS OF THIS PARAGRAPH 5 AND TO THEIR REASONABLENESS.

6. SUBSTITUTIONS AND MODIFICATIONS

UMC may at any time make substitutions and modifications to products which do not materially and adversely affect overall product performance within the then current UMC specifications in the typical and intended use. In addition, UMC reserves the right to halt production or alter specifications and prices at any time without notice. Buyer agrees to verify that the data sheets and other information are current before placing orders.

7. CANCELLATION

- (a) This contract may not be cancelled by Buyer except with written consent by UMC and Buyer's payment of reasonable cancellation charges (including but not be limited to expenses already incurred for labor and material, overhead, commitments made by UMC, and a reasonable profit).
- (b) In no event will Buyer have rights in partially completed goods.

8. INDEMNIFICATION

UMC will, at its own expense, defend and/or settle all suits against Buyer to the extent based on any valid claim that any parts as shipped by UMC under this purchase order infringe any valid, enforceable, unexpired R.O.C. patent, copyright or trademark provided, however, that Buyer (i) gives immediate written notice to UMC, (ii) permits UMC to defend, and (iii) gives UMC all needed information, assistance, and authority. However, UMC will not be responsible for infringements resulting from anything not manufactured entirely by UMC, or from any combination with products, equipment or materials not furnished by UMC. UMC shall have no liability under this Paragraph 8 for any products made to Buyer's specifications, code, or design. THIS PARAGRAPH STATES UMC'S ENTIRE LIABILITY AND OBLIGATION WITH RESPECT TO INTELLECTUAL OR INDUSTRIAL PROPERTY INFRINGEMENT OR CLAIMS THEREFORE. Except as to claims UMC agrees to defend, BUYER WILL INDEMNIFY, DEFEND AND HOLD HARMLESS UMC FROM ALL CLAIMS, COSTS, LOSSES, AND DAMAGES (INCLUDING ATTORNEYS' FEES) AGAINST AND/OR ARISING OUT OF GOODS SOLD AND/OR SHIPPED HEREUNDER.

9. NO CONFIDENTIAL INFORMATION

UMC shall have no obligation to hold any information in confidence except as provided in a separate non-disclosure agreement signed by both parties.

10. ENTIRE AGREEMENT

- (a) These terms and conditions are the entire agreement between UMC and Buyer, and no addition, deletion or modification shall be binding on UMC unless expressly agreed to in a writing signed by an officer of UMC.
- (b) Buyer is not relying upon any warranty or representation except for those specifically stated here.

11. APPLICABLE LAW

This contract and all performance and disputes arising out of or relating to goods involved will be governed by the laws of Taiwan, Republic of China, without reference to conflict of laws principles and excluding the U.N. Convention on Contracts for the International Sale of Goods. Buyer agrees at its sole expense to comply with all applicable laws in connection with the purchase, use or sale of the goods provided hereunder.

12. JURISDICTION AND VENUE

The courts located in Taiwan, Republic of China, will have the sole and exclusive jurisdiction and venue over any dispute arising out of or relating to this contract or any sale of goods hereunder, and Buyer hereby consents to the jurisdiction of such courts.

13. ATTORNEYS' FEES

Reasonable attorneys' fees and costs will be awarded to the prevailing party in the event of litigation involving the enforcement or interpretation of this contract.



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