



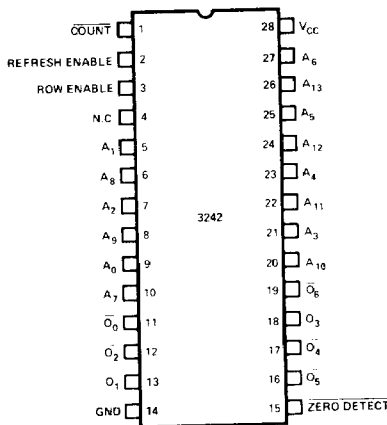
# 3242 ADDRESS MULTIPLEXER AND REFRESH COUNTER FOR 16K DYNAMIC RAMs

- Ideal For 2116
- Simplifies System Design
- Reduces Package Count
- Standard 28-Pin DIP
- Suitable For Either Distributed Or Burst Refresh
- Single Power Supply:  
+5 Volts  $\pm 10\%$
- Address Input to Output Delay:  
9ns Driving 15 pF,  
25ns Driving 250pF

The Intel® 3242 is an address multiplexer and refresh counter for multiplexed address dynamic RAMs requiring refresh of 64 or 128 cycles. It multiplexes 14 bits of system supplied address to 7 output address pins. The device also contains a 7 bit refresh counter which is externally controlled so that either distributed or burst refresh may be used. The high performance of the 3242 makes it especially suitable for use with high speed N-channel RAMs like the 2116.

The 3242 operates from a single +5 volt power supply and is specified for operation over a 0 to +75°C ambient temperature range. It is fabricated by means of Intel's highly reliable Schottky bipolar process and is packaged in a hermetically sealed 28 pin Type D package.

**PIN CONFIGURATION**



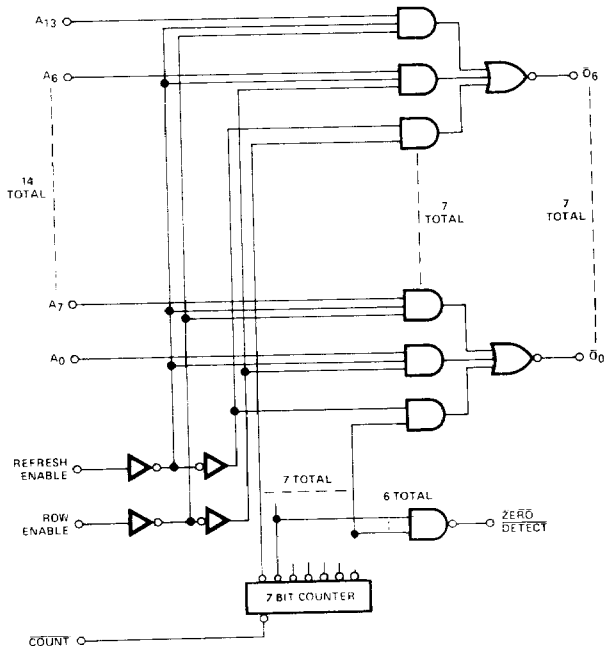
NOTE: A<sub>0</sub> THROUGH A<sub>6</sub> ARE ROW ADDRESSES  
A<sub>7</sub> THROUGH A<sub>13</sub> ARE COLUMN ADDRESSES

**TRUTH TABLE AND DEFINITIONS:**

| REFRESH ENABLE | ROW ENABLE | OUTPUT   |
|----------------|------------|--|
| H              | X          | REFRESH ADDRESS (FROM INTERNAL COUNTER)                  |
| L              | H          | ROW ADDRESS (A <sub>0</sub> THROUGH A <sub>6</sub> )     |
| L              | L          | COLUMN ADDRESS (A <sub>7</sub> THROUGH A <sub>13</sub> ) |

COUNT - ADVANCES INTERNAL REFRESH COUNTER.  
ZERO DETECT - INDICATES ZERO IN THE FIRST 6 SIGNIFICANT REFRESH COUNTER BITS (USED IN BURST REFRESH MODE)

**LOGIC DIAGRAM**



## A.C. Characteristics

All Limits Apply for  $V_{CC} = +5.0V \pm 10\%$ ,  $T_A = 0^\circ C$  to  $75^\circ C$ , Load = 1 TTL,  $C_L = 250pF$ , Unless Otherwise Specified.

| SYMBOL    | PARAMETER                      | MIN. | TYP. <sup>(1)</sup> | MAX. | UNIT | CONDITIONS                              |
|-----------|--------------------------------|------|---------------------|------|------|---|
| $t_{AO}$  | Address Input to Output Delay  |      | 6                   | 9    | ns   | Refresh Enable = Low <sup>(2)(3)</sup>  |
| $t_{AO1}$ | Address Input to Output Delay  |      | 16                  | 25   | ns   | Refresh Enable = Low                    |
| $t_{OO}$  | Row Enable to Output Delay     | 7    | 12                  | 27   | ns   | Refresh Enable = Low <sup>(2)(3)</sup>  |
| $t_{OO1}$ | Row Enable to Output Delay     | 12   | 28                  | 41   | ns   | Refresh Enable = Low                    |
| $t_{EO}$  | Refresh Enable to Output Delay | 7    | 14                  | 27   | ns   | Notes 2, 3                              |
| $t_{EO1}$ | Refresh Enable to Output Delay | 12   | 30                  | 45   | ns   |   |
| $t_{CO}$  | Count to Output                | 15   | 40                  | 60   | ns   | Refresh Enable = High <sup>(2)(3)</sup> |
| $t_{CO1}$ | Count to Output                | 20   | 55                  | 80   | ns   | Refresh Enable = High                   |
| $f_c$     | Counting Frequency             |      |                     | 5    | MHz  |   |
| $t_{CPW}$ | Count Pulse Width              | 35   |                     |      | ns   |   |
| $t_{cz}$  | Count to Zero Detect           | 15   |                     | 70   | ns   | Note 3                                  |

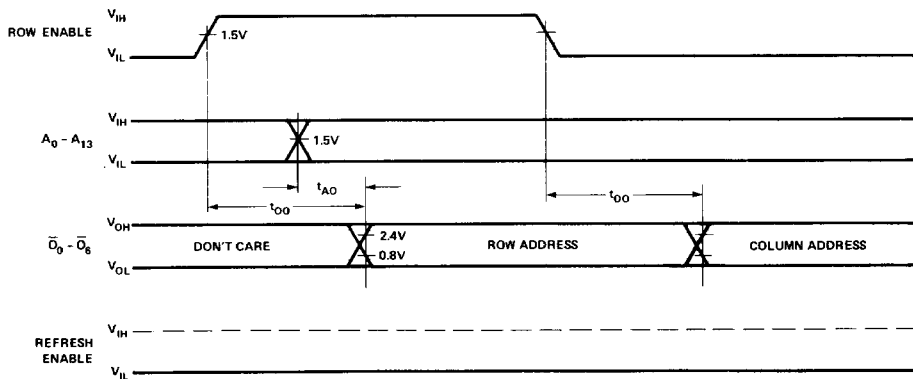
Notes: 1. Typical values are for  $T_A = 25^\circ C$  and  $V_{CC} = 5.0V$ .

2.  $T_A = 25^\circ C$ ,  $V_{CC} = 5.0V$ .

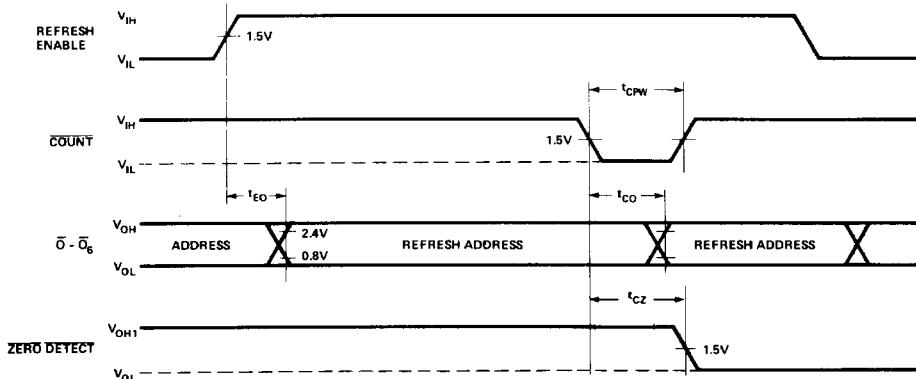
3.  $C_L = 15 pF$ .

## A.C. TIMING WAVEFORMS (Typically used with 2116)

### NORMAL CYCLE



### REFRESH CYCLE



## Absolute Maximum Ratings\*

|  |                   |
|--|-------------------|
| Temperature Under Bias .....                   | -10° to +85° C    |
| Storage Temperature .....                      | -65° to +150° C   |
| All Input, Output, or<br>Supply Voltages ..... | -0.5V to +7 Volts |
| Output Currents .....                          | 100mA             |
| Power Dissipation .....                        | 1W                |

### \*COMMENT:

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

## D.C. and Operating Characteristics

All Limits Apply for  $V_{CC} = 5.0V \pm 10\%$ ,  $T_A = 0^\circ C$  to  $+75^\circ C$

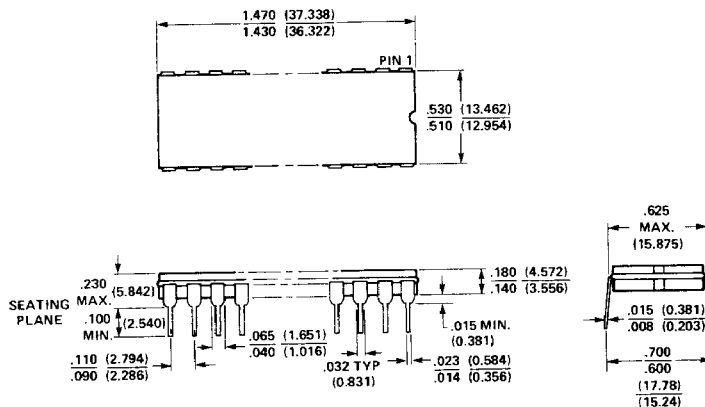
| SYMBOL    | PARAMETER   | LIMITS |          |       | UNIT    | TEST CONDITIONS           |
|-----------|---|--------|----------|-------|---------|---------------------------|
|           |   | MIN.   | TYP. (1) | MAX.  |         |                           |
| $I_I$     | Input Load Current  |        | -0.04    | -0.25 | mA      | $V_{IN} = 0.45V$ , Note 2 |
| $I_R$     | Input Leakage Current                                       |        | 0.01     | 10    | $\mu A$ | $V_{IN} = 5.5V$           |
| $V_{IH}$  | Input High Voltage  | 2.0    |          |       | V       |                           |
| $V_{IL}$  | Input Low Voltage   |        |          | 0.8   | V       |                           |
| $V_{OL}$  | Output Low Voltage  |        | 0.25     | 0.40  | V       | $I_{OL} = 8mA$            |
| $V_{OH}$  | Output High Voltage ( $\overline{O}_0$ - $\overline{O}_6$ ) | 3.0    | 4.0      |       | V       | $I_{OH} = -1mA$           |
| $V_{OH1}$ | Output High Voltage (Zero Detect)                           | 2.4    | 3.3      |       | V       | $I_{OH} = -1mA$           |
| $I_{CC}$  | Power Supply Current  |        | 105      | 165   | mA      | $V_{CC} = 5.5V$           |

Notes: 1. Typical values are for  $T_A = 25^\circ C$  and  $V_{CC} = 5.0V$ .

2. Inputs are high impedance, TTL compatible, and suitable for bus operation.

## Packaging Information

### 28 LEAD HERMETIC DUAL IN-LINE PACKAGE TYPE D



## PIN NAMES AND FUNCTIONS

| Pin No.              | Pin Name                                | Function  |
|----------------------|---|---|
| 1                    | Count Input*                            | Active low input increments internal 7-bit counter by one for each count pulse in.  |
| 2                    | Refresh Enable Input*                   | Active high input which determines whether the 3242 is in refresh mode (H) or address enable (L).   |
| 9,5,7,21,23,25,27    | A <sub>0</sub> –A <sub>6</sub> Inputs*  | Row address inputs.   |
| 10,6,8,20,22,24,26   | A <sub>7</sub> –A <sub>13</sub> Inputs* | Column address inputs.  |
| 11,13,12,18,17,16,19 | $\bar{O}_0$ – $\bar{O}_6$ Outputs       | Address outputs to memories. Inverted with respect to address inputs.   |
| 14                   | GND                                     | Power supply ground.  |
| 15                   | $\bar{Zero}$ Detect Output              | Active low output which senses that the six low order bits of refresh address in the counter are zero. Can be used in the burst mode to sense refresh completion. |
| 3                    | Row Enable Input*                       | High input selects row, low input selects column addresses of the driven memories.  |
| 28                   | V <sub>CC</sub>                         | +5V power supply input.   |

\*The inputs are high impedance, TTL compatible, and suitable for bus operation.

## DEVICE OPERATION

The Intel® 3242 Address Multiplexer/Refresh Counter performs the following functions:

1. Row, Column and Refresh Address multiplexing.
2. Address Counting for burst or distributed refresh.

These functions are controlled by two signals: Refresh Enable and Row Enable, both of which are active high TTL inputs. The truth table on page 1 shows the levels required to multiplex to the output:

1. Refresh addresses (from internal counter).

2. Row addresses (A<sub>0</sub> through A<sub>6</sub>).
3. Column addresses (A<sub>7</sub> through A<sub>13</sub>).

## Burst Refresh Mode

When refresh is requested, the refresh enable input is high. This input is ANDed with the seven outputs of the internal 7-bit counter. At each Count pulse the counter increments by one, sequencing the outputs ( $\bar{O}_0$ – $\bar{O}_6$ ) through 128 row addresses. When the first six significant bits of the counter sequence to all zeros, the  $\bar{Zero}$  Detect output goes low, signaling the end of the refresh sequence. Due to counter decoding spikes, the  $\bar{Zero}$  Detect output is valid only after  $t_{CZ}$  following the low-going edge of Count. The  $\bar{Zero}$  Detect output used in this manner signals the completion of 64 refresh cycles. To use the 128-cycle burst refresh mode, an external flip-flop must be driven by the  $\bar{Zero}$  Detect.

## Distributed Refresh Mode

In the distributed refresh mode, one row is selected for refresh each ( $t_{REFRESH}/n$ ) time where  $n$  = number of refresh cycles required for the device and  $t_{REFRESH}$  is the specified refresh rate for the device. For the 2116  $t_{REFRESH} = 2$  msec and  $n = 128$  or 64, therefore, one row is refreshed each 15.5 or 31  $\mu$ sec, respectively. Following the refresh cycle at row  $n_x$ , the Count input is pulsed, advancing the refresh address by one row so that the next refresh cycle will be performed on row  $n_{x+1}$ . The Count input may be pulsed following each refresh cycle or within the refresh cycle after the specified memory device address hold time.

## Row and Column Address

All 14 system address lines are applied to the inputs of the 3242. When Refresh Enable is low and Row Enable is high, input addresses A<sub>0</sub>–A<sub>6</sub> are gated to the outputs and applied to the driven memories. Conversely, when Row Enable is low (with Refresh Enable still low), input addresses A<sub>7</sub>–A<sub>13</sub> are gated to the outputs and applied to the driven memories. Figure 1 shows a typical connection between the 3242 and the 2116 16K dynamic RAM. When the memory devices are driven directly by the 3242, the address applied to the memory devices is the inverse of the address at the 3242 inputs due to the inverted outputs of the 3242. This should be remembered when checking out the memory system.

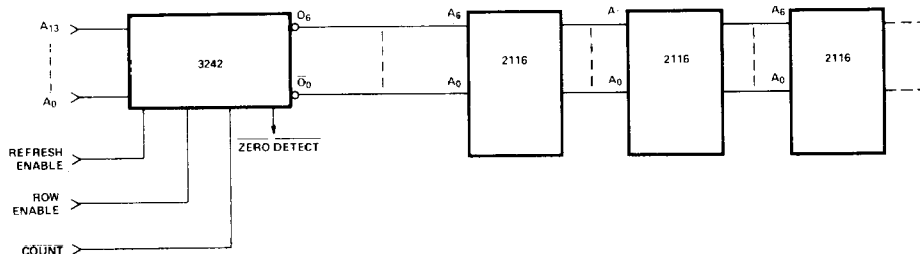


Figure 1. Typical Connection of 3242 and 2116 Memories.