

**FEATURES**

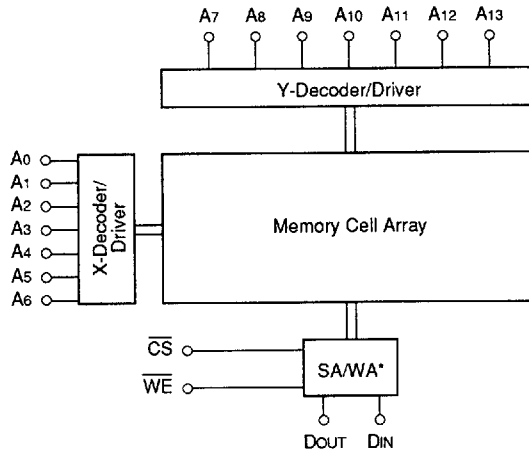
- Address access time, tAA: 6/8/10ns max.
- Chip select access time, tAC: 3ns max.
- Edge rate, tr/tr: 500ps (typ.)
- Write recovery times under 5ns
- Power supply current, IEE: -260mA
- Superior immunity against alpha particles provides virtually no soft error sensitivity
- Built with advanced ASSET™ I technology
- Fully compatible with industry standard 10K/100K ECL I/O levels
- Noise margins improved with on-chip voltage and temperature compensation
- Open emitter output for easy memory expansion
- Available in hermetic DIP
- ESD Protection of 2000V

**DESCRIPTION**

The Synergy SY10/100/101480 are 16384-bit Random Access Memories (RAMs), designed with advanced Emitter Coupled Logic (ECL) circuitry. The devices are organized as 16384-words-by-1-bit and meet the standard 10K/100K family signal levels. The SY100480 is also supply voltage-compatible with 100K ECL, while the SY101480 operates from 10K ECL supply voltage (-5.2V). All feature on-chip voltage and temperature compensation for improved noise margin.

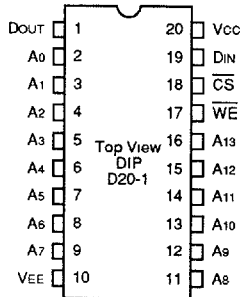
The SY10/100/101480 employ proprietary circuit design techniques and Synergy's proprietary ASSET I advanced bipolar technology to achieve extremely fast access, write pulse width and write recovery times. ASSET I uses proprietary technology concepts to achieve significant reduction in parasitic capacitance while improving device packing density. Synergy's circuit design techniques, coupled with ASSET I, result not only in ultra-fast performance, but also allow device operation at reduced power levels with virtually no soft error sensitivity and with outstanding device reliability in volume production.

**BLOCK DIAGRAM**



\* SA = Sense Amplifier  
 WA = Write Amplifier

**PIN CONFIGURATIONS**



**PIN NAMES**

| Label                            | Function       |
|----------------------------------|----------------|
| A <sub>0</sub> - A <sub>13</sub> | Address Inputs |
| $\overline{CS}$                  | Chip Select    |
| $\overline{WE}$                  | Write Enable   |
| DIN                              | Data Input     |
| DOUT                             | Data Output    |
| Vcc                              | GND (0V)       |
| VEE                              | Supply Voltage |

**TRUTH TABLE**

| Input           |                 |     | Output | Mode      |
|-----------------|-----------------|-----|--------|-----------|
| $\overline{CS}$ | $\overline{WE}$ | DIN |        |           |
| H               | X               | X   | L      | Disabled  |
| L               | L               | H   | L      | Write "H" |
| L               | L               | L   | L      | Write "L" |
| L               | H               | X   | DOUT   | Read      |

**NOTE:**  
H = High Voltage Level  
L = Low Voltage Level  
X = Don't Care

**FUNCTIONAL DESCRIPTION**

The Synergy SY10/100/101480 are 16384-bit RAMS organized as 16384-words-by-1-bit. Memory cell selection is achieved by using the 14 address bits designated as A<sub>0</sub> through A<sub>13</sub>. Each of the 2<sup>14</sup> possible input address combinations corresponds to a unique word location in memory. The active low Chip Select ( $\overline{CS}$ ) is provided for memory expansion. The active low Write Enable ( $\overline{WE}$ ) controls the read and write operation. Data resident on the DIN input is written into the addressed location only when  $\overline{WE}$  and  $\overline{CS}$  are held low. In order to perform a read

operation,  $\overline{WE}$  is held high,  $\overline{CS}$  is held low and the non-inverted output data at the addressed location is transferred to DOUT to be read out. Open emitter outputs are provided for maximum flexibility and memory expansion by allowing output wire-OR connections. External termination of 50Ω to -2.0V or an equivalent circuit must be used to provide the specified output levels.

The output is brought to a logical low level when the RAM is being written into ( $\overline{WE}$  = LOW) or when the device is deselected via the active low chip select pin ( $\overline{CS}$  = HIGH).

### ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

| Rating                          | Symbol             | Value        | Unit |
|---------------------------------|--------------------|--------------|------|
| VEE Pin Potential to VCC Pin    | VEE                | +0.5 to -7.0 | V    |
| Input Voltage                   | V <sub>IN</sub>    | +0.5 to -2.0 | V    |
| DC Output Current (Output High) | I <sub>OUT</sub>   | -30          | mA   |
| Temperature Under Bias          | T <sub>C</sub>     | -55 to +125  | °C   |
| Storage Temperature             | T <sub>store</sub> | -65 to +150  | °C   |

**NOTE:**

1 Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. This is a stress rating only and functional operation is not implied at conditions other than those detailed in the operational sections of this data sheet. Exposure to ABSOLUTE MAXIMUM RATING conditions for extended periods may affect device reliability.

### GUARANTEED OPERATING CONDITIONS

| Parameter                     | Symbol | Min.           | Typ.  | Max. | Unit  |    |
|-------------------------------|--------|----------------|-------|------|-------|----|
| Supply Voltage <sup>(1)</sup> | 10K    | VEE            | -5.46 | -5.2 | -4.94 | V  |
|                               |        | T <sub>C</sub> | 0     | —    | 75    | °C |
| Case Temperature              | 100K   | VEE            | -4.8  | -4.5 | -4.2  | V  |
|                               |        | T <sub>C</sub> | 0     | —    | 85    | °C |
| Supply Voltage <sup>(1)</sup> | 101K   | VEE            | -5.46 | -5.2 | -4.94 | V  |
|                               |        | T <sub>C</sub> | 0     | —    | 85    | °C |

**NOTE:**

1 Referenced to V<sub>cc</sub>.

### RISE AND FALL TIME

| Parameter        | Code <sup>(1)</sup> | Symbol         | Min. | Typ. | Max. | Unit |
|------------------|---------------------|----------------|------|------|------|------|
| Output Rise Time | F                   | t <sub>r</sub> | —    | 500  | —    | ps   |
| Output Fall Time | F                   | t <sub>f</sub> | —    | 500  | —    | ps   |

**NOTE:**

1 F = Fast Edge Rate  
 S = Standard Edge Rate

### CAPACITANCE

| Parameter              | Symbol           | Min. | Typ. | Max. | Unit |
|------------------------|------------------|------|------|------|------|
| Input Pin Capacitance  | C <sub>IN</sub>  | —    | 4    | —    | pF   |
| Output Pin Capacitance | C <sub>OUT</sub> | —    | 5    | —    | pF   |

## 10K DC ELECTRICAL CHARACTERISTICS

V<sub>CC</sub> = 0V; T<sub>C</sub> = 0°C to +75°C; V<sub>EE</sub> = -5.2V; Airflow > 2.5m/s; Output Load = 50Ω to -2.0V

| Symbol           | Parameter                                 | T <sub>c</sub>        | Min.                    | Max.                    | Unit | Condition  |
|------------------|---|-----------------------|-------------------------|-------------------------|------|--|
| V <sub>OH</sub>  | Output High Voltage                       | 0°C<br>+25°C<br>+75°C | -1000<br>-960<br>-900   | -840<br>-810<br>-720    | mV   | V <sub>IN</sub> = V <sub>IH</sub> Max. or V <sub>IL</sub> Min. |
| V <sub>OL</sub>  | Output Low Voltage                        | 0°C<br>+25°C<br>+75°C | -1870<br>-1850<br>-1830 | -1665<br>-1650<br>-1625 | mV   | V <sub>IN</sub> = V <sub>IH</sub> Max. or V <sub>IL</sub> Min. |
| V <sub>OHC</sub> | Output High Voltage                       | 0°C<br>+25°C<br>+75°C | -1020<br>-980<br>-920   | —<br>—<br>—             | mV   | V <sub>IN</sub> = V <sub>IH</sub> Min. or V <sub>IL</sub> Max. |
| V <sub>OLC</sub> | Output Low Voltage                        | 0°C<br>+25°C<br>+75°C | —<br>—<br>—             | -1645<br>-1630<br>-1605 | mV   | V <sub>IN</sub> = V <sub>IH</sub> Min. or V <sub>IL</sub> Max. |
| V <sub>IH</sub>  | Input High Voltage                        | 0°C<br>+25°C<br>+75°C | -1145<br>-1105<br>-1045 | -840<br>-810<br>-720    | mV   | Guaranteed Input Voltage High for All Inputs                   |
| V <sub>IL</sub>  | Input Low Voltage                         | 0°C<br>+25°C<br>+75°C | -1870<br>-1850<br>-1830 | -1490<br>-1475<br>-1450 | mV   | Guaranteed Input Voltage Low for All Inputs                    |
| I <sub>IH</sub>  | Input High Current                        | 0°C to +75°C          | 0.0                     | 20                      | μA   | V <sub>IN</sub> = V <sub>IH</sub> Max.                         |
| I <sub>IL</sub>  | Input Low Current                         | 0°C to +75°C          | -2                      | 2                       | μA   | V <sub>IN</sub> = V <sub>IL</sub> Min.                         |
| I <sub>IL</sub>  | $\overline{CS}$ Input Low Current         | 0°C to +75°C          | 30                      | 170                     | μA   | V <sub>IN</sub> = V <sub>IL</sub> Min.                         |
| I <sub>IH</sub>  | $\overline{CS}$ Input High Current        | 0°C to +75°C          | 40                      | 220                     | μA   | V <sub>IN</sub> = V <sub>IH</sub> Max.                         |
| I <sub>IL</sub>  | $\overline{WE}$ Input Low Current         | 0°C to +75°C          | -2                      | 35                      | μA   | V <sub>IN</sub> = V <sub>IL</sub> Min.                         |
| I <sub>IH</sub>  | $\overline{WE}$ Input High Current        | 0°C to +75°C          | 0.0                     | 60                      | μA   | V <sub>IN</sub> = V <sub>IH</sub> Max.                         |
| IEE              | Power Supply Current<br>-6, -8ns<br>-10ns | 0°C to +75°C          | -260<br>-220            | —<br>—                  | mA   | All Inputs and Outputs Open                                    |

### 100K/101K DC ELECTRICAL CHARACTERISTICS

V<sub>CCA</sub> = 0V  
 V<sub>CC</sub> = 0V

V<sub>EE</sub> = -4.5V (100K)  
 V<sub>EE</sub> = -5.2V (101K)

T<sub>c</sub> = 0°C to +85°C

Airflow > 2.5m/s  
 Output Load = 50Ω to -2.0V

| Symbol           | Parameter                                 | Min.         | Max.   | Unit | Condition  |
|------------------|---|--------------|--------|------|--|
| V <sub>OH</sub>  | Output High Voltage                       | -1025        | -880   | mV   | V <sub>IN</sub> = V <sub>IH</sub> Max. or V <sub>IL</sub> Min. |
| V <sub>OL</sub>  | Output Low Voltage                        | -1810        | -1620  | mV   | V <sub>IN</sub> = V <sub>IH</sub> Max. or V <sub>IL</sub> Min. |
| V <sub>OHC</sub> | Output High Voltage                       | -1035        | —      | mV   | V <sub>IN</sub> = V <sub>IH</sub> Min. or V <sub>IL</sub> Max. |
| V <sub>OLC</sub> | Output Low Voltage                        | —            | -1610  | mV   | V <sub>IN</sub> = V <sub>IH</sub> Min. or V <sub>IL</sub> Max. |
| V <sub>IH</sub>  | Input High Voltage                        | -1165        | -880   | mV   | Guaranteed Input Voltage High for All Inputs                   |
| V <sub>IL</sub>  | Input Low Voltage                         | -1810        | -1475  | mV   | Guaranteed Input Voltage Low for All Inputs                    |
| I <sub>IH</sub>  | Input High Current                        | 0.0          | 20     | μA   | V <sub>IN</sub> = V <sub>IH</sub> Max.                         |
| I <sub>IL</sub>  | Input Low Current                         | -2           | 2      | μA   | V <sub>IN</sub> = V <sub>IL</sub> Min.                         |
| I <sub>IL</sub>  | $\overline{CS}$ Input Low Current         | 30           | 170    | μA   | V <sub>IN</sub> = V <sub>IL</sub> Min.                         |
| I <sub>IH</sub>  | $\overline{CS}$ Input High Current        | 40           | 220    | μA   | V <sub>IN</sub> = V <sub>IH</sub> Max.                         |
| I <sub>IL</sub>  | $\overline{WE}$ Input Low Current         | -2           | 35     | μA   | V <sub>IN</sub> = V <sub>IL</sub> Min.                         |
| I <sub>IH</sub>  | $\overline{WE}$ Input High Current        | 0.0          | 60     | μA   | V <sub>IN</sub> = V <sub>IH</sub> Max.                         |
| I <sub>EE</sub>  | Power Supply Current<br>-6, -8ns<br>-10ns | -260<br>-220 | —<br>— | mA   | All Inputs and Outputs Open                                    |

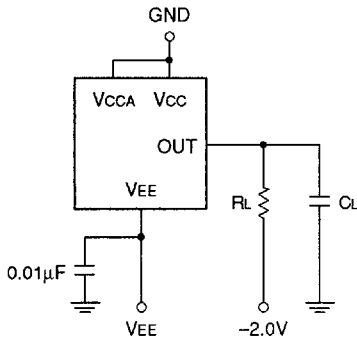
**AC ELECTRICAL CHARACTERISTICS**

**AC TEST CONDITIONS**

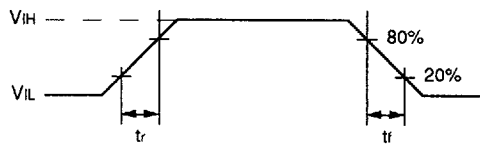
VCC = VCCA = 0V      Output Load = 50Ω to -2.0V  
 VEE = -5.2V ± 5%(10K)      Tc = 0°C to +75°C (10K)  
 VEE = -4.5V ± 0.3V(100K)      Tc = 0°C to +85°C (100K/101K)  
 VEE = -5.2V ± 5%(101K)      Airflow > 2.5m/s

|          | Tc           | V <sub>IH</sub> | V <sub>IL</sub> |
|----------|--------------|-----------------|-----------------|
| 10K      | 0°C          | -0.933V         | -1.733V         |
|          | +25°C        | -0.90V          | -1.70V          |
|          | +75°C        | -0.863V         | -1.663V         |
| 100/101K | 0°C to +85°C | -0.90V          | -1.70V          |

**Loading Condition**



**Input Pulse**



tr = tf = 10ns typ

OUTPUT LOAD

RL = 50Ω

CL = 5pF\* (typ)

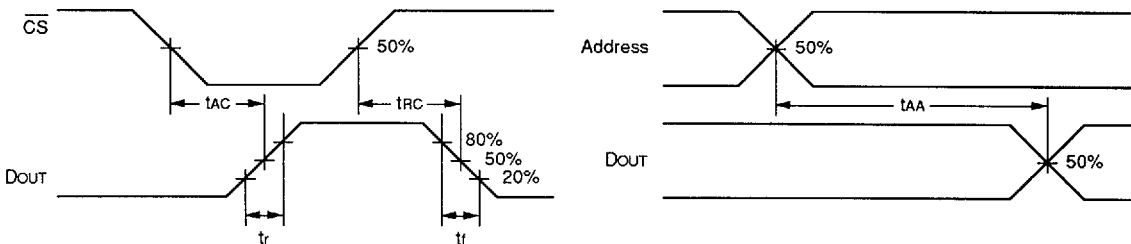
\* (Modeled as 50Ω transmission line terminated to -2V.)

**NOTE:** All timing measurements referenced to 50% input levels

**READ CYCLE**

| Symbol | Parameter | SY10480-6<br>SY100480-6<br>SY101480-6 |      | SY10480-8<br>SY100480-8<br>SY101480-8 |      | SY10480-10<br>SY100480-10<br>SY101480-10 |      | Unit |    |
|--------|-----------|---------------------------------------|------|---------------------------------------|------|--|------|------|----|
|        |           | Min.                                  | Max. | Min.                                  | Max. | Min.                                     | Max. |      |    |
| tAA    | TAVQV     | Address Access Time                   | —    | 6                                     | —    | 8  | —    | 10   | ns |
| tAC    | TSLQV     | Chip Select Access Time               | —    | 3                                     | —    | 3  | —    | 3    | ns |
| tRC    | TSHQL     | Chip Select Recovery Time             | —    | 3                                     | —    | 3  | —    | 3    | ns |

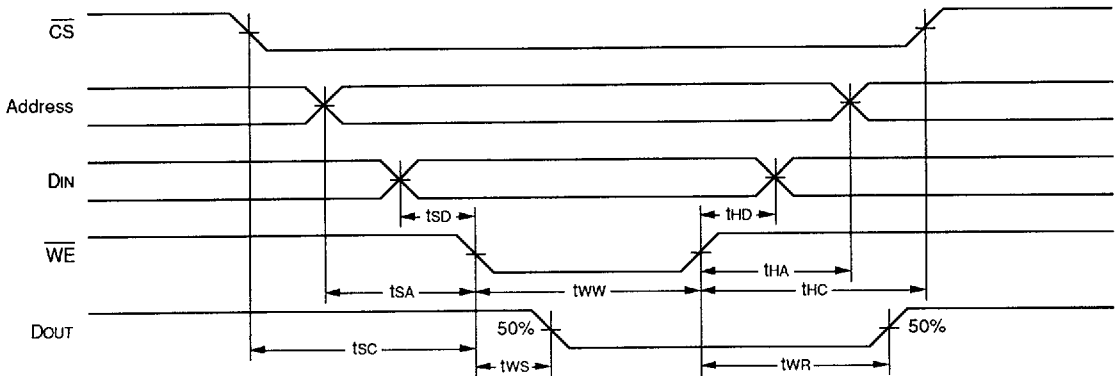
**READ CYCLE TIMING DIAGRAM**



## WRITE CYCLE

| Symbol          |       | Parameter               | SY10480-6<br>SY100480-6<br>SY101480-6 |      | SY10480-8<br>SY100480-8<br>SY101480-8 |      | SY10480-10<br>SY100480-10<br>SY101480-10 |      | Unit |
|-----------------|-------|-------------------------|---------------------------------------|------|---------------------------------------|------|--|------|------|
|                 |       |                         | Min.                                  | Max. | Min.                                  | Max. | Min.                                     | Max. |      |
| t <sub>WW</sub> | TWLWH | Write Pulse Width       | 6                                     | —    | 8                                     | —    | 10                                       | —    | ns   |
| t <sub>WS</sub> | TWLQL | Write Disable Time      | —                                     | 3    | —                                     | 4    | —  | 5    | ns   |
| t <sub>WR</sub> | TWHQV | Write Recovery Time     | —                                     | 5    | —                                     | 5    | —  | 5    | ns   |
| t <sub>SA</sub> | TAVWL | Address Set-up Time     | 1                                     | —    | 1                                     | —    | 1  | —    | ns   |
| t <sub>SC</sub> | TSLWL | Chip Select Set-up Time | 1                                     | —    | 1                                     | —    | 1  | —    | ns   |
| t <sub>SD</sub> | TDVWL | Data Set-up Time        | 1                                     | —    | 1                                     | —    | 1  | —    | ns   |
| t <sub>HA</sub> | TWHAX | Address Hold Time       | 1                                     | —    | 1                                     | —    | 1  | —    | ns   |
| t <sub>HC</sub> | TWHSX | Chip Select Hold Time   | 1                                     | —    | 1                                     | —    | 1  | —    | ns   |
| t <sub>HD</sub> | TWHDX | Data Hold Time          | 1                                     | —    | 1                                     | —    | 1  | —    | ns   |

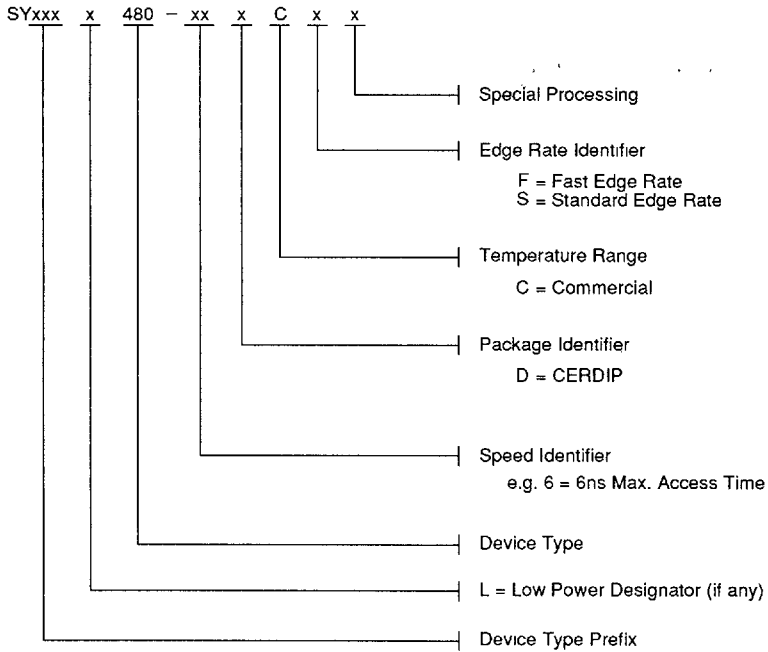
## WRITE CYCLE TIMING DIAGRAM



**PRODUCT ORDERING CODE**

| Speed (ns) | Ordering Code                  | Edge Rate        | Package Type | Operating Range |
|------------|--------------------------------|------------------|--------------|-----------------|
| 6          | SY10480-6DCF                   | Fast             | D20-1        | Commercial      |
| 6          | SY100480-6DCF                  | Fast             | D20-1        | Commercial      |
| 6          | SY101480-6DCF                  | Fast             | D20-1        | Commercial      |
| 8          | SY10480-8DCF<br>SY10480-8DCS   | Fast<br>Standard | D20-1        | Commercial      |
| 8          | SY100480-8DCF<br>SY100480-8DCS | Fast<br>Standard | D20-1        | Commercial      |

| Speed (ns) | Ordering Code                  | Edge Rate        | Package Type | Operating Range |
|------------|--------------------------------|------------------|--------------|-----------------|
| 8          | SY101480-8DCF<br>SY101480-8DCS | Fast<br>Standard | D20-1        | Commercial      |
| 10         | SY10480-10DCS                  | Standard         | D20-1        | Commercial      |
| 10         | SY100480-10DCS                 | Standard         | D20-1        | Commercial      |
| 10         | SY101480-10DCS                 | Standard         | D20-1        | Commercial      |



10 = 10KH DC Levels with -5.2V ± 5% Supply  
 100 = 100K DC Levels with -4.5V ± 0.3V Supply  
 101 = 100K DC Levels with -5.2V ± 5% Supply