

## FEATURES

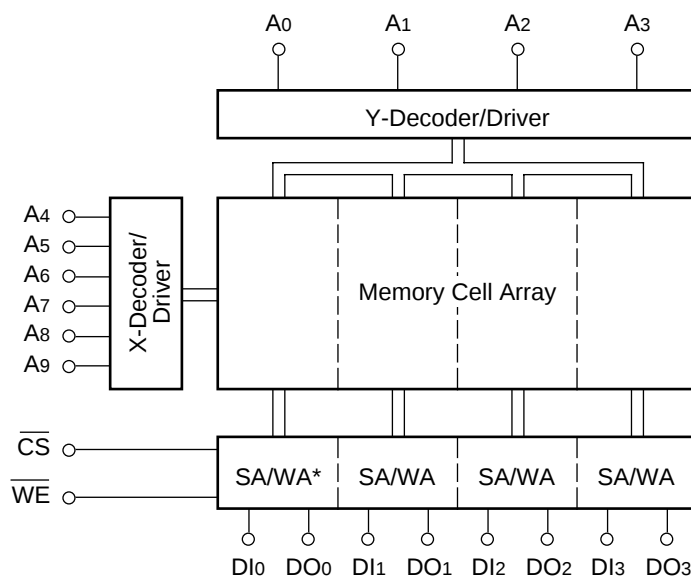
- Address access time,  $t_{AA}$ : 3/4/5/7ns max.
- Chip select access time,  $t_{AC}$ : 2ns max.
- Write pulse width,  $t_{WW}$ : 3ns min.
- Edge rate,  $t_r/t_f$ : 500ps typ.
- Power supply current,  $I_{EE}$ : -300mA, -220mA for -5/7ns
- Superior immunity against alpha particles provides virtually no soft error sensitivity
- Built with advanced ASSET™ 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
- ESD protection of 2000V
- Available in 24-pin Flatpack and 28-pin PLCC and MLCC packages

## DESCRIPTION

The Synergy SY10/100/101474 are 4096-bit Random Access Memories (RAMs), designed with advanced Emitter Coupled Logic (ECL) circuitry. The devices are organized as 1024-words-by-4-bits and meet the standard 10K/100K family signal levels. The SY100474 is also supply voltage-compatible with 100K ECL, while the SY101474 operates from 10K ECL supply voltage (-5.2V). All feature on-chip voltage and temperature compensation for improved noise margin.

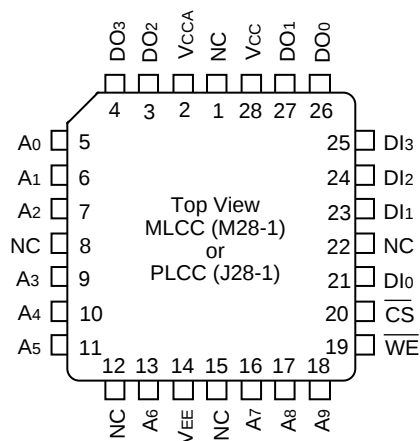
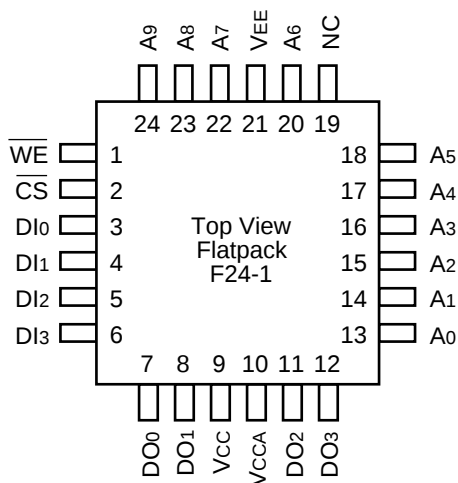
The SY10/100/101474 employ proprietary circuit design techniques and Synergy's proprietary ASSET advanced bipolar technology to achieve extremely fast access, write pulse width and write recovery times. ASSET uses proprietary technology concepts to achieve significant reduction in parasitic capacitance while improving device packing density. Synergy's circuit design techniques, coupled with ASSET, result not only in ultra-fast performance, but also allow device operation 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           |
|-----------|--------------------|
| A0 - A9   | Address Inputs     |
| CS        | Chip Select        |
| WE        | Write Enable       |
| DI0 - DI3 | Data Input (DIN)   |
| DO0 - DO3 | Data Output (DOUT) |
| VCC       | GND (0V)           |
| VCCA      | Output GND (0V)    |
| VEE       | Supply Voltage     |
| NC        | No Connect         |

## TRUTH TABLE

| Input |    |     | Output | Mode      |
|-------|----|-----|--------|-----------|
| CS    | 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 SY10/100/101474 are 4096-bit RAMs organized as 1024-words-by-4-bits. Memory cell selection is achieved by using the 10 address bits designated as A0 through A9. Each of the  $2^{10}$  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  $\overline{DIN}$  inputs (D0 through D3) 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  $\overline{DOUT}$  (DO0 through DO3) to be read out. Open emitter outputs are provided for maximum flexibility and memory expansion by allowing output wire-OR connections. External termination of  $50\Omega$  to  $-2.0V$  or an equivalent circuit must be used to provide the specified output levels.

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

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

| Symbol      | Rating                                 | Value            | Unit               |
|-------------|----------------------------------------|------------------|--------------------|
| $V_{EE}$    | $V_{EE}$ Pin Potential to $V_{CC}$ Pin | +0.5 to $-7.0$   | V                  |
| $V_{IN}$    | Input Voltage                          | +0.5 to $V_{EE}$ | V                  |
| $I_{OUT}$   | DC Output Current (Output High)        | $-30$            | mA                 |
| $T_C$       | Temperature Under Bias                 | $-55$ to $+125$  | $^{\circ}\text{C}$ |
| $T_{store}$ | Storage Temperature                    | $-65$ to $+150$  | $^{\circ}\text{C}$ |

### 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> | $V_{EE}$ | $-5.46$ | $-5.2$ | $-4.94$ | V    |
| Case Temperature              |          |         |        |         |      |
| Supply Voltage <sup>(1)</sup> | $V_{EE}$ | $-4.8$  | $-4.5$ | $-4.2$  | V    |
| Case Temperature              |          |         |        |         |      |
| Supply Voltage <sup>(1)</sup> | $V_{EE}$ | $-5.46$ | $-5.2$ | $-4.94$ | V    |
| Case Temperature              |          |         |        |         |      |

### NOTE:

1. Referenced to  $V_{CC}$ .

## RISE AND FALL TIME

| Parameter        | Code <sup>(1)</sup> | Symbol | Min.   | Typ.        | Max.   | Unit |
|------------------|---------------------|--------|--------|-------------|--------|------|
| Output Rise Time | F<br>S              | $t_r$  | —<br>— | 500<br>1500 | —<br>— | ps   |
| Output Fall Time | F<br>S              | $t_f$  | —<br>— | 500<br>1500 | —<br>— | ps   |

### NOTE:

1. F = Fast Edge Rate  
S = Standard Edge Rate

## CAPACITANCE

| Parameter              | Symbol    | Min. | Typ. | Max. | Unit |
|------------------------|-----------|------|------|------|------|
| Input Pin Capacitance  | $C_{IN}$  | —    | 4    | —    | pF   |
| Output Pin Capacitance | $C_{OUT}$ | —    | 5    | —    | pF   |

## 10K DC ELECTRICAL CHARACTERISTICS

VCC = 0V; TC = 0°C to +75°C; VEE = -5.2V; Airflow > 2.5m/s; Output Load = 50Ω to -2.0V

| Symbol | Parameter                                        | Tc                    | Min.                    | Max.                    | Unit | Condition                                    |
|--------|--------------------------------------------------|-----------------------|-------------------------|-------------------------|------|----------------------------------------------|
| VOH    | Output High Voltage                              | 0°C<br>+25°C<br>+75°C | -1000<br>-960<br>-900   | -840<br>-810<br>-720    | mV   | VIN = VIH Max. or VIL Min.                   |
| VOL    | Output Low Voltage                               | 0°C<br>+25°C<br>+75°C | -1870<br>-1850<br>-1830 | -1665<br>-1650<br>-1625 | mV   | VIN = VIH Max. or VIL Min.                   |
| VOHC   | Output High Voltage                              | 0°C<br>+25°C<br>+75°C | -1020<br>-980<br>-920   | —<br>—<br>—             | mV   | VIN = VIH Min. or VIL Max.                   |
| VOLC   | Output Low Voltage                               | 0°C<br>+25°C<br>+75°C | —<br>—<br>—             | -1645<br>-1630<br>-1605 | mV   | VIN = VIH Min. or VIL Max.                   |
| VIH    | 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 |
| VIL    | 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  |
| IiH    | Input High Current                               | 0°C to +75°C          | 0.0                     | 20                      | μA   | VIN = VIH Max.                               |
| IiL    | Input Low Current                                | 0°C to +75°C          | -2                      | 2                       | μA   | VIN = VIL Min.                               |
| IiL    | $\overline{\text{CS}}$ Input Low Current         | 0°C to +75°C          | 30                      | 170                     | μA   | VIN = VIL Min.                               |
| IiH    | $\overline{\text{CS}}$ Input High Current        | 0°C to +75°C          | 40                      | 220                     | μA   | VIN = VIH Max.                               |
| IiL    | $\overline{\text{WE}}$ Input Low Current         | 0°C to +75°C          | -2                      | 35                      | μA   | VIN = VIL Min.                               |
| IiH    | $\overline{\text{WE}}$ Input High Current        | 0°C to +75°C          | 0.0                     | 60                      | μA   | VIN = VIH Max.                               |
| IEE    | Power Supply Current<br>-3ns, -4ns<br>-5ns, -7ns | 0°C to +75°C          | -300<br>-220            | —                       | mA   | All Inputs and Outputs Open                  |

## 100K/101K DC ELECTRICAL CHARACTERISTICS

VCCA = 0V  
VCC = 0V

VEE = -4.5V (100K)  
VEE = -5.2V (101K)

TC = 0°C to +85°C

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

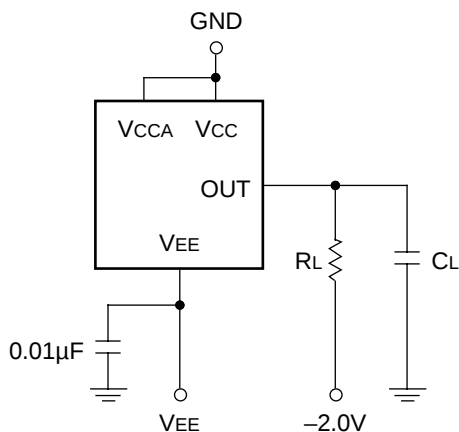
| Symbol | Parameter                                      | Min.         | Max.  | Unit | Condition                                    |
|--------|------------------------------------------------|--------------|-------|------|----------------------------------------------|
| VOH    | Output High Voltage                            | -1025        | -880  | mV   | VIN = VIH Max. or VIL Min.                   |
| VOL    | Output Low Voltage                             | -1810        | -1620 | mV   | VIN = VIH Max. or VIL Min.                   |
| VOHC   | Output High Voltage                            | -1035        | —     | mV   | VIN = VIH Min. or VIL Max.                   |
| VOLC   | Output Low Voltage                             | —            | -1610 | mV   | VIN = VIH Min. or VIL Max.                   |
| VIH    | Input High Voltage                             | -1165        | -880  | mV   | Guaranteed Input Voltage High for All Inputs |
| VIL    | Input Low Voltage                              | -1810        | -1475 | mV   | Guaranteed Input Voltage Low for All Inputs  |
| IiH    | Input High Current                             | 0.0          | 20    | μA   | VIN = VIH Max.                               |
| IiL    | Input Low Current                              | -2           | 2     | μA   | VIN = VIL Min.                               |
| IiL    | $\overline{\text{CS}}$ Input Low Current       | 30           | 170   | μA   | VIN = VIL Min.                               |
| IiH    | $\overline{\text{CS}}$ Input High Current      | 40           | 220   | μA   | VIN = VIH Max.                               |
| IiL    | $\overline{\text{WE}}$ Input Low Current       | -2           | 35    | μA   | VIN = VIL Min.                               |
| IiH    | $\overline{\text{WE}}$ Input High Current      | 0.0          | 60    | μA   | VIN = VIH Max.                               |
| IEE    | Power Supply Current<br>3ns, 4ns<br>-5ns, -7ns | -300<br>-220 | —     | mA   | All Inputs and Outputs Open                  |

## AC ELECTRICAL CHARACTERISTICS

### AC TEST CONDITIONS

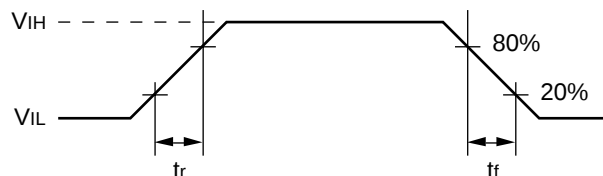
$V_{CC} = V_{CCA} = 0V$  Output Load =  $50\Omega$  to  $-2.0V$   
 $V_{EE} = -5.2V \pm 5\%(10K)$   $T_C = 0^\circ C$  to  $+75^\circ C$  (10K)  
 $V_{EE} = -4.5V \pm 0.3V(100K)$   $T_C = 0^\circ C$  to  $+85^\circ C$  (100K/101K)  
 $V_{EE} = -5.2V \pm 5\%(101K)$  Airflow > 2.5m/s

#### Loading Condition



|          | $T_C$                                         | $V_{IH}$                           | $V_{IL}$                           |
|----------|-----------------------------------------------|------------------------------------|------------------------------------|
| 10K      | $0^\circ C$<br>$+25^\circ C$<br>$+75^\circ C$ | $-0.933V$<br>$-0.90V$<br>$-0.863V$ | $-1.733V$<br>$-1.70V$<br>$-1.663V$ |
| 100/101K | $0^\circ C$ to $+85^\circ C$                  | $-0.90V$                           | $-1.70V$                           |

#### Input Pulse



$t_r = t_f = 1.0ns$  typ.

OUTPUT LOAD:  $R_L = 50\Omega$

$C_L = 5pF^*$  (typ.)

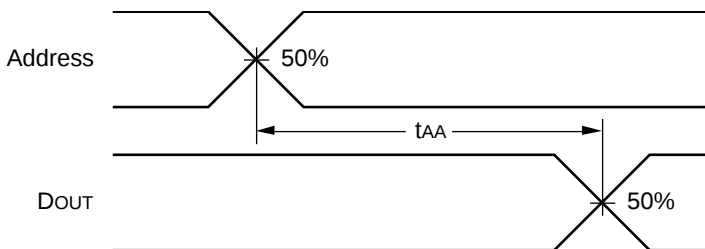
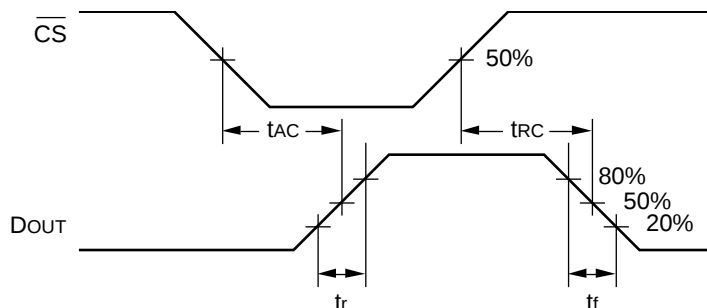
\* (Modeled as  $50\Omega$  transmission line terminated to  $-2V$ .)

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

### READ CYCLE

| Symbol   | Parameter                       | SY10474-3<br>SY100474-3<br>SY101474-3 |      | SY10474-4<br>SY100474-4<br>SY101474-4 |      | SY10474-5<br>SY100474-5<br>SY101474-5 |      | SY10474-7<br>SY100474-7<br>SY101474-7 |      | Unit |
|----------|---------------------------------|---------------------------------------|------|---------------------------------------|------|---------------------------------------|------|---------------------------------------|------|------|
|          |                                 | Min.                                  | Max. | Min.                                  | Max. | Min.                                  | Max. | Min.                                  | Max. |      |
| $t_{AA}$ | TAVQV Address Access Time       | —                                     | 3    | —                                     | 4    | —                                     | 5    | —                                     | 7    | ns   |
| $t_{AC}$ | TSLQV Chip Select Access Time   | —                                     | 2    | —                                     | 2    | —                                     | 3    | —                                     | 3    | ns   |
| $t_{RC}$ | TSHQL Chip Select Recovery Time | —                                     | 2    | —                                     | 2    | —                                     | 3    | —                                     | 3    | ns   |

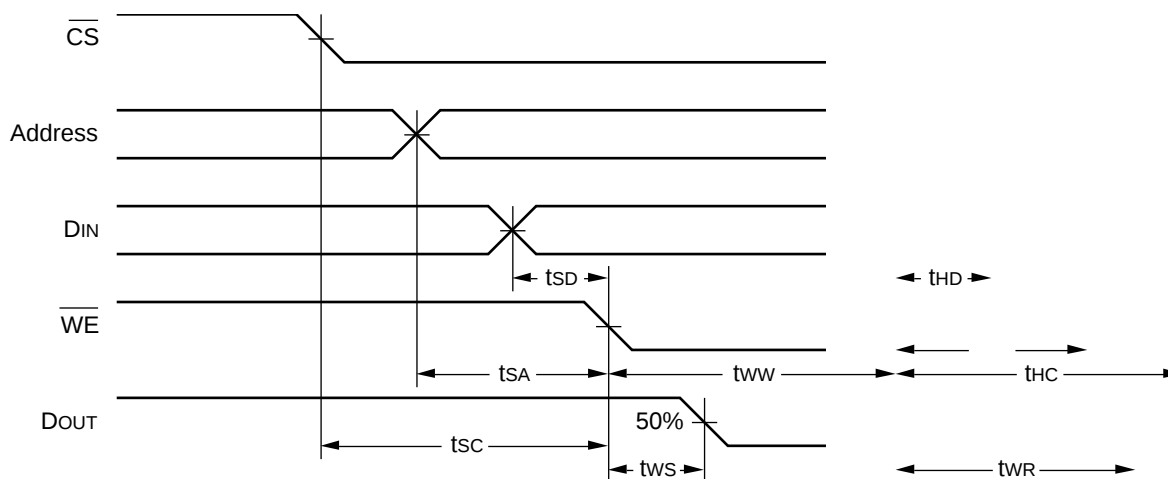
### READ CYCLE TIMING DIAGRAM



## WRITE CYCLE

| Symbol          |       | Parameter               | SY10474-3<br>SY100474-3<br>SY101474-3 |      | SY10474-4<br>SY100474-4<br>SY101474-4 |      | SY10474-5<br>SY100474-5<br>SY101474-5 |      | SY10474-7<br>SY100474-7<br>SY101474-7 |      | Units |
|-----------------|-------|-------------------------|---------------------------------------|------|---------------------------------------|------|---------------------------------------|------|---------------------------------------|------|-------|
|                 |       |                         | Min.                                  | Max. | Min.                                  | Max. | Min.                                  | Max. | Min.                                  | Max. |       |
| t <sub>WW</sub> | TWLWH | Write Pulse Width       | 3                                     | —    | 4                                     | —    | 5                                     | —    | 5                                     | —    | ns    |
| t <sub>WS</sub> | TWLQL | Write Disable Time      | —                                     | 2    | —                                     | 2    | —                                     | 3    | —                                     | 4    | ns    |
| t <sub>WR</sub> | TWHQV | Write Recovery Time     | —                                     | 3    | —                                     | 4    | —                                     | 5    | —                                     | 5    | ns    |
| t <sub>SA</sub> | TAVWL | Address Set-up Time     | 1                                     | —    | 1                                     | —    | 1                                     | —    | 1                                     | —    | ns    |
| t <sub>SC</sub> | TSLWL | Chip Select Set-up Time | 0                                     | —    | 0                                     | —    | 0.5                                   | —    | 1                                     | —    | ns    |
| t <sub>SD</sub> | TDVWL | Data Set-up Time        | 0                                     | —    | 0                                     | —    | 0.5                                   | —    | 1                                     | —    | ns    |
| t <sub>HA</sub> | TWHAX | Address Hold Time       | 1                                     | —    | 1                                     | —    | 1                                     | —    | 1                                     | —    | ns    |
| t <sub>HC</sub> | TWHSX | Chip Select Hold Time   | 1                                     | —    | 1                                     | —    | 1                                     | —    | 1                                     | —    | ns    |
| t <sub>HD</sub> | TWHDX | Data Hold Time          | 1                                     | —    | 1                                     | —    | 1                                     | —    | 1                                     | —    | ns    |

## WRITE CYCLE TIMING DIAGRAM



## PRODUCT ORDERING CODE

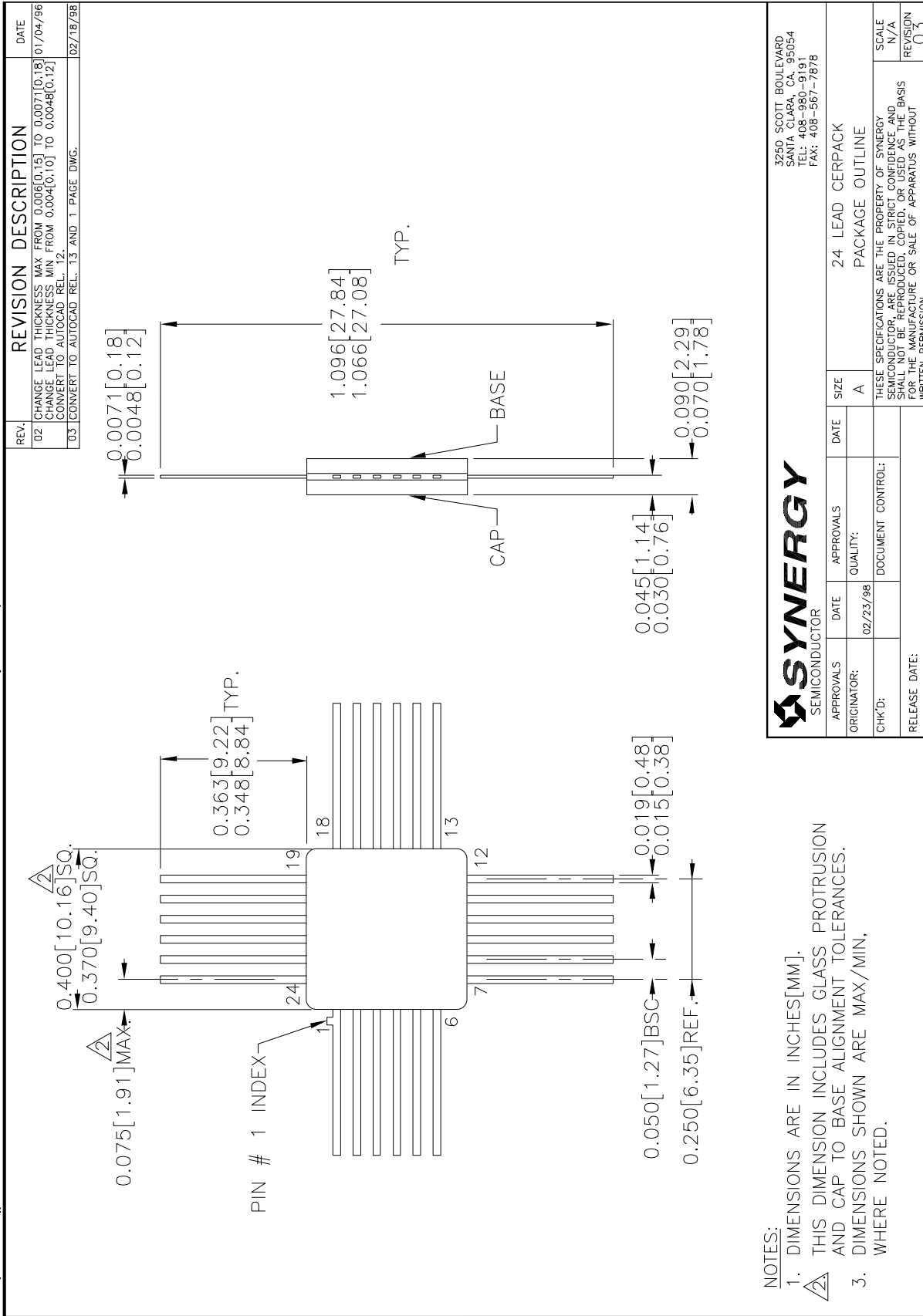
| Speed (ns) | Ordering Code          | Edge Rate | Package Type | Operating Range |
|------------|------------------------|-----------|--------------|-----------------|
| 3          | SY10/100/101474-3FCF   | Fast      | F24-1        | Commercial      |
|            | SY10/100/101474-3MCF   | Fast      | M28-1        | Commercial      |
| 4          | SY10/100/101474-4FCF   | Fast      | F24-1        | Commercial      |
|            | SY10/100/101474-4MCF   | Fast      | M28-1        | Commercial      |
| 5          | SY10/100/101474-5FCS   | Standard  | F24-1        | Commercial      |
|            | SY10/100/101474-5JCS   | Standard  | J28-1        | Commercial      |
|            | SY10/100/101474-5JCSTR | Standard  | J28-1        | Commercial      |
| 7          | SY10/100/101474-7FCS   | Standard  | F24-1        | Commercial      |
|            | SY10/100/101474-7JCS   | Standard  | J28-1        | Commercial      |
|            | SY10/100/101474-7JCSTR | Standard  | J28-1        | Commercial      |

# 24 LEAD CERPACK (F24-1)

FILE/REV #: PD0006A03

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## NOTES:

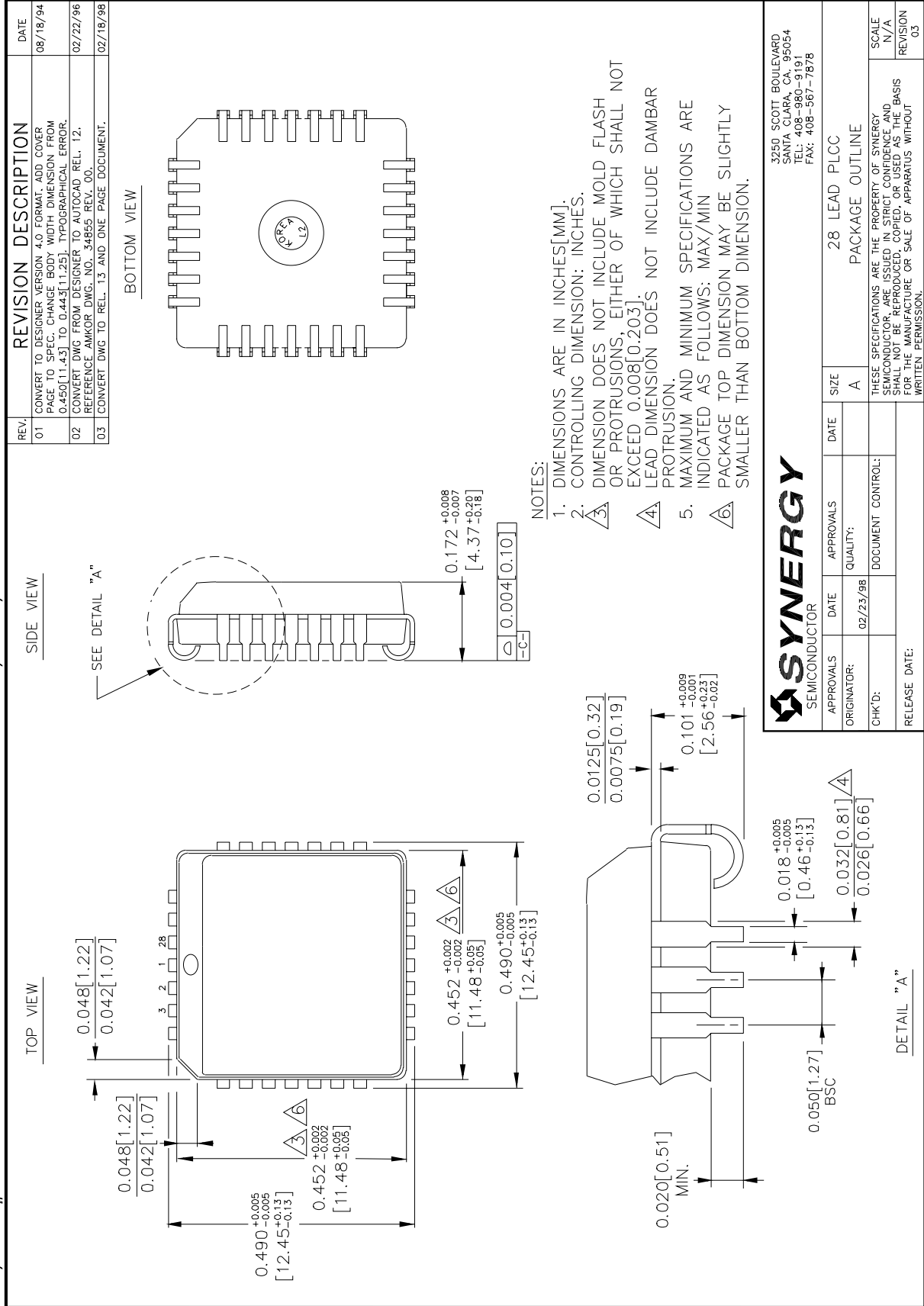
1. DIMENSIONS ARE IN INCHES[MM].
2. THIS DIMENSION INCLUDES GLASS PROTRUSION AND CAP TO BASE ALIGNMENT TOLERANCES.
3. DIMENSIONS SHOWN ARE MAX/MIN, WHERE NOTED.

# 28 LEAD PLASTIC LEADED CHIP CARRIER (J28-1)

FILE/REV #: PD0008A03

PD/0008/ASCORP

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