

PRELIMINARY SPECIFICATION



GoldStar
GOLD STAR CO., LTD.

GM71C4256
262,144 WORDS x 4 BIT
CMOS DYNAMIC RAM

T-46-23-17

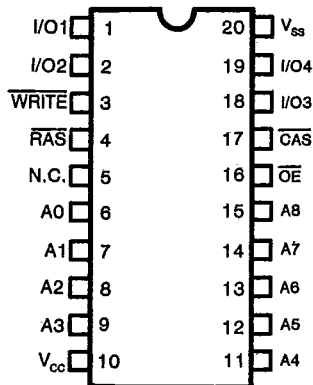
Description

The GM71C4256 is the new generation dynamic RAM organized 262,144x4 Bit. The GM71C4256 utilizes GoldStar's silicon Gate process technology as well as advanced circuit techniques to provide wide operating margins, both internally and to the system user. Multiplexed address inputs permit the GM71C4256 to be packaged in a standard 20 pin DIP. The package size provides high system bit densities and is compatible with widely available automated testing and insertion equipment. System oriented features include single power supply of 5V±10% tolerance, direct interfacing capability with high performance logic families such as Schottky TTL.

Features

- 262,144 x 4 Bit organization
- Fast access time and cycle time: 85/100/120(Max)

Pin Configuration



- A₀-A₈ Address Inputs
- $\overline{\text{RAS}}$ Row Address Strobe
- $\overline{\text{CAS}}$ Column Address Strobe
- $\overline{\text{WRITE}}$ Read/Write Input
- $\overline{\text{OE}}$ Output Enable
- I/O1~I/O4 Data Input/Output
- V_{CC} Power (+5V)
- V_{SS} Ground
- N.C. No Connection

| PARAMETER | | GM71C4256(ns) | | |
|------------------|-------------------------------------|---------------|-----|-----|
| | | -85 | -10 | -12 |
| t _{RAC} | $\overline{\text{RAS}}$ Access Time | 85 | 100 | 120 |
| t _{AA} | Column Address Access Time | 45 | 50 | 60 |
| t _{CAC} | $\overline{\text{CAS}}$ Access Time | 30 | 30 | 35 |
| t _{RC} | Cycle Time | 165 | 190 | 220 |
| t _{PC} | Fast Page Mode Cycle Time | 50 | 55 | 70 |

- Single Power Supply of 5V±10% with a built-in V_{BB} generator
- Low Power
 - 330mW MAX. Operating (GM71C4256-85)
 - 274mW MAX. Operating (GM71C4256-12)
 - 16.5mW MAX. Standby
- Output unlatched at cycle end allows two-dimensional chip selection
- Read-Modify-Write, $\overline{\text{RAS}}$ -only refresh, and Fast Page Mode Capability
- All input and output TTL compatible
- 512 refresh cycles/8ms
- Industry standard 20 pin Plastic DIP

Absolute Maximum Ratings

| | | |
|------------------------------|-----------|-----------|
| Input Voltage | V_{IN} | -1~7V |
| Output Voltage | V_{OUT} | -1~7V |
| Power Supply Voltage | V_{CC} | -1~7V |
| Operating Temperature | T_{OPR} | 0~70°C |
| Storage Temperature | T_{STG} | -55~150°C |
| Short Circuit Output Current | I_{OUT} | 50mA |

Recommended DC Operating Conditions

| | |
|--|-----------------------------|
| $(T_A=0^\circ\text{C to }+70^\circ\text{C})$ | |
| V_{CC} | Supply Voltage 4.5~5.5V |
| V_{IH} | Input High Voltage 2.4~6.5V |
| V_{IL} | Input Low Voltage -1.0~0.8V |

(Note 2)

(Note 1)

Functional Block Diagram

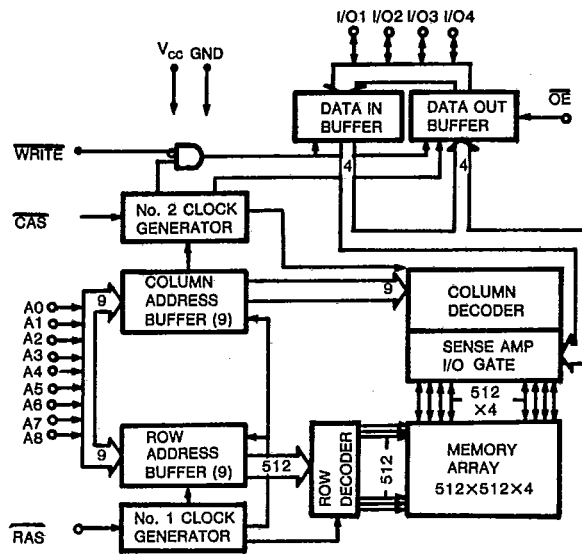


Figure 1

GM71C4256

DC Electrical Characteristics: ($V_{CC}=5\pm 10\%$, $T_A=0 \sim 70^\circ\text{C}$)

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| SYMBOL | PARAMETER | MIN | MAX | UNIT | NOTES |
|-----------|--|-----|-----|---------------|-----------|
| V_{OH} | Output Level Output "H" Level Voltage ($I_{OUT}=-5\text{mA}$) | 2.4 | — | V | |
| V_{OL} | Output Level Output "L" Level Voltage ($I_{OUT}=4.2\text{mA}$) | — | 0.4 | V | |
| I_{CC1} | Operating Current | 85 | — | 70 | mA 3,4 |
| | Average Power Supply Operating Current (\overline{RAS} , \overline{CAS} , Address Cycling: $t_{RC}=t_{RC}$ MIN) | 100 | — | 65 | |
| | | 120 | — | 55 | |
| I_{CC2} | Standby Current Power Supply Standby Current ($\overline{RAS}=\overline{CAS}=V_{IH}$) | — | 3 | mA | |
| I_{CC3} | \overline{RAS} Only Refresh Current | 85 | — | 75 | mA 3 |
| | Average Power Supply Current \overline{RAS} Only Mode (\overline{RAS} Cycling, $\overline{CAS}=V_{IH}$; $t_{RC}=t_{RC}$ MIN) | 100 | — | 65 | |
| | | 120 | — | 55 | |
| I_{CC4} | Fast Page Mode Current | 85 | — | 55 | mA 3,4 |
| | Average Power Supply Current Fast Page Mode ($\overline{RAS}=V_{IL}$, \overline{CAS} , Address Cycling: $t_{PC}=t_{PC}$ MIN) | 100 | — | 45 | |
| | | 120 | — | 35 | |
| I_{CC5} | Standby Current Power Supply Standby Current ($\overline{RAS}=\overline{CAS}=V_{CC}-0.2\text{V}$) | — | 1 | mA | |
| I_{IL} | Input Leakage Current Any Input ($0\text{V}\leq V_{IN}\leq 6.5\text{V}$, All other Pins Not Under Test = 0V) | -10 | 10 | μA | |
| I_{OL} | Output Leakage Current (D_{OUT} is Disabled, $0\text{V}\leq V_{OUT}\leq V_{CC}$) | -10 | 10 | μA | |

Capacitance ($V_{CC}=5\text{V}\pm 10\%$, $f=1\text{MHz}$, $T_A=0\sim 70^\circ\text{C}$)

| SYMBOL | PARAMETER | MIN | MAX | UNIT |
|----------|--|-----|-----|------|
| C_{I1} | Input Capacitance (A0—A8) | — | 5 | pF |
| C_{I2} | Input Capacitance (\overline{RAS} , \overline{CAS} , \overline{WRITE} , \overline{OE}) | — | 7 | pF |
| C_O | Output Capacitance ($I/O_1-I/O_4$) | — | 7 | pF |

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GM71C4256

Electrical Characteristics And Recommended AC Operating Conditions ($V_{CC}=5V\pm 10\%$, $T_A=0\sim 70^\circ C$)
(Note 5,6,7)

| SYMBOL | PARAMETER | GM71C4256-85 | | GM71C4256-10 | | GM71C4256-12 | | UNIT | NOTES |
|------------|---|--------------|---------|--------------|---------|--------------|---------|------|-------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | | |
| t_{RC} | Random Read/Write Cycle Time | 165 | — | 190 | — | 220 | — | ns | |
| t_{RMW} | Read-Modify-Write Cycle Time | 225 | — | 225 | — | 295 | — | ns | |
| t_{PC} | Fast Page Mode Cycle Time | 50 | — | 55 | — | 70 | — | ns | |
| t_{PRMW} | Fast Page Mode Read-Modify-Write Cycle Time | 110 | — | 115 | — | 140 | — | ns | |
| t_{RAC} | Access Time from \overline{RAS} | — | 85 | — | 100 | — | 120 | ns | 8, 13 |
| t_{CAC} | Access Time from \overline{CAS} | — | 30 | — | 30 | — | 35 | ns | 8, 13 |
| t_{AA} | Access Time from Column Address | — | 45 | — | 50 | — | 60 | ns | 8, 14 |
| t_{CPA} | Access Time from \overline{CAS} Precharge | — | 45 | — | 50 | — | 65 | ns | 8, 14 |
| t_{CLZ} | \overline{CAS} to Output in Low-Z | 5 | — | 5 | — | 5 | — | ns | 5 |
| t_{OFF} | Output Buffer Turn-off Delay | 0 | 30 | 0 | 30 | 0 | 35 | ns | 9 |
| t_T | Transition Time (Rise and Fall) | 3 | 50 | 3 | 50 | 3 | 50 | ns | 7 |
| t_{RP} | \overline{RAS} Precharge Time | 70 | — | 80 | — | 90 | — | ns | |
| t_{RAS} | \overline{RAS} Pulse Width | 85 | 10,000 | 100 | 10,000 | 120 | 10,000 | ns | |
| t_{RASP} | \overline{RAS} Pulse Width (Fast Page Mode) | 85 | 100,000 | 100 | 100,000 | 120 | 100,000 | ns | |
| t_{RSH} | \overline{RAS} Hold Time | 30 | — | 30 | — | 35 | — | ns | |
| t_{CSH} | \overline{CAS} Hold Time | 85 | — | 100 | — | 120 | — | ns | |
| t_{CAS} | \overline{CAS} Pulse Width | 30 | 10,000 | 30 | 10,000 | 35 | 10,000 | ns | |
| t_{RCD} | \overline{RAS} to \overline{CAS} Delay Time | 25 | 55 | 25 | 70 | 25 | 85 | ns | 13 |
| t_{RAD} | \overline{RAS} to Column Address Delay Time | 20 | 40 | 20 | 50 | 20 | 60 | ns | 14 |
| t_{CRP} | \overline{CAS} to \overline{RAS} Precharge Time | 10 | — | 10 | — | 10 | — | ns | |
| t_{CPN} | \overline{CAS} Precharge Time | 15 | — | 15 | — | 20 | — | ns | |
| t_{CP} | \overline{CAS} Precharge Time (Fast Page Mode) | 10 | — | 10 | — | 15 | — | ns | |
| t_{ASR} | Row Address Set-Up Time | 0 | — | 0 | — | 0 | — | ns | |
| t_{RAH} | Row Address Hold Time | 15 | — | 15 | — | 15 | — | ns | |
| t_{ASC} | Column Address Set-Up Time | 0 | — | 0 | — | 0 | — | ns | |
| t_{CAH} | Column Address Hold Time | 20 | — | 20 | — | 25 | — | ns | |
| t_{AR} | Column Address Hold Time Referenced to \overline{RAS} | 65 | — | 75 | — | 90 | — | ns | |
| t_{RAL} | Column Address to \overline{RAS} Lead Time | 45 | — | 50 | — | 60 | — | ns | |
| t_{RCS} | Read Command Set-Up Time | 0 | — | 0 | — | 0 | — | ns | 10 |
| t_{RCH} | Read Command Hold Time | 0 | — | 0 | — | 0 | — | ns | 10 |
| t_{RRH} | Read Command Hold Time Referenced to \overline{RAS} | 0 | — | 0 | — | 0 | — | ns | 10 |

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GM71C4256

 $(V_{CC}=5V\pm 10\%, T_A=0\sim 70^\circ C)$ Unit: nS (Note 5,6,7)

| SYMBOL | PARAMETER | GM71C4256-85 | | GM71C4256-10 | | GM71C4256-12 | | UNIT | NOTES |
|-----------|--|--------------|-----|--------------|-----|--------------|-----|------|-------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | | |
| t_{WCH} | Write Command Hold Time | 20 | — | 20 | — | 25 | — | ns | |
| t_{WCR} | Write Command Hold Time Referenced to \overline{RAS} | 65 | — | 75 | — | 90 | — | ns | |
| t_{WP} | Write Command Pulse Width | 20 | — | 20 | — | 25 | — | ns | |
| t_{RWL} | Write Command to \overline{RAS} Lead Time | 20 | — | 25 | — | 30 | — | ns | |
| t_{CWL} | Write Command to \overline{CAS} Lead Time | 20 | — | 25 | — | 30 | — | ns | |
| t_{DS} | Data Set-Up Time | 0 | — | 0 | — | 0 | — | ns | 11 |
| t_{DH} | Data Hold Time | 20 | — | 20 | — | 25 | — | ns | 11 |
| t_{DHR} | Data Hold Time Referenced to \overline{RAS} | 65 | — | 75 | — | 90 | — | ns | |
| t_{REF} | Refresh Period | — | 8 | — | 8 | — | 8 | ms | |
| t_{WCS} | Write Command Set-Up Time | 0 | — | 0 | — | 0 | — | ns | 12 |
| t_{CWD} | \overline{CAS} to Write Delay Time | 65 | — | 65 | — | 75 | — | ns | 12 |
| t_{RWD} | \overline{RAS} to Write Delay Time | 120 | — | 135 | — | 160 | — | ns | 12 |
| t_{AWD} | Column Address to Write Delay | 80 | — | 85 | — | 100 | — | ns | 12 |
| t_{RPC} | \overline{RAS} to \overline{CAS} Precharge Time | 0 | — | 0 | — | 0 | — | ns | |
| t_{ROH} | \overline{RAS} Hold Time Referenced to \overline{OE} | 20 | — | 20 | — | 20 | — | ns | |
| t_{OEA} | \overline{OE} Access Time | — | 25 | — | 25 | — | 30 | ns | |
| t_{OED} | \overline{OE} to Data Delay | 25 | — | 25 | — | 30 | — | ns | |
| t_{OEZ} | Output buffer turn off Delay Time from \overline{OE} | 0 | 25 | 0 | 25 | 0 | 30 | ns | |
| t_{OEH} | \overline{OE} Command Hold Time | 25 | — | 25 | — | 30 | — | ns | |

Notes

- Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device.
- All Voltage are referenced to V_{SS} .
- I_{CC1} , I_{CC3} , I_{CC4} depend on cycle rate.
- I_{CC1} , I_{CC4} depend on output loading. Specified values are obtained with the output open.
- An initial pause of 200 μ S is required after power-up followed by 8 \overline{RAS} cycles before proper device operation is achieved.
- AC measurements assume $t_r=5$ nS.
- $V_{IH}(\text{min})$ and $V_{IL}(\text{max})$ are referenced levels for measuring timing of input signals. Also transition times are required between V_{IH} and V_{IL} .
- Measured with a load equivalent to 2 TTL loads and 100pF.
- $t_{OFF}(\text{max})$ and $t_{OEZ}(\text{max})$ defines the time at which the output achieves the open circuit condition and is not referenced to output voltage levels.
- Either t_{RCH} or t_{RRH} must be satisfied for a read cycle.
- These parameters are referenced to \overline{CAS} leading edge in early write cycles and to \overline{WRITE} leading edge in read-modify-write cycles.
- t_{WCS} , t_{RWD} , t_{CWD} and t_{AWD} are not restrictive operating parameters. They are included the data sheet as electrical characteristics only. If $t_{WCS} > t_{WCS}(\text{min})$ the cycle is early write cycle and data out pin will remain open circuit (high impedance) through the entire cycle; if $t_{RWD} > t_{RWD}(\text{min})$, $t_{CWD} > t_{CWD}(\text{min})$ and $t_{AWD} > t_{AWD}(\text{min})$ the cycle is a read-write cycle and data out will contain data read from the selected cell; if neither of the above sets of conditions is satisfied, the condition of the data out (at access time) is indeterminate.
- Operation within the $t_{RCD}(\text{max})$ limit insures that $t_{RAC}(\text{max})$ can be met. $t_{RCD}(\text{max})$ is specified as a referenced point only; if t_{RCD} is greater than the specified $t_{RCD}(\text{max})$ limit, then access time is controlled by t_{CAC} .
- Operation within the $t_{RAD}(\text{max})$ limit insures that $t_{RAC}(\text{max})$ can be met. $t_{RAD}(\text{max})$ is specified as a referenced point only; if t_{RAD} is greater than the specified $t_{RAD}(\text{max})$ limit, then access time is controlled by t_{AA} .

GM71C4256

Timing Waveforms

T-46-23-17

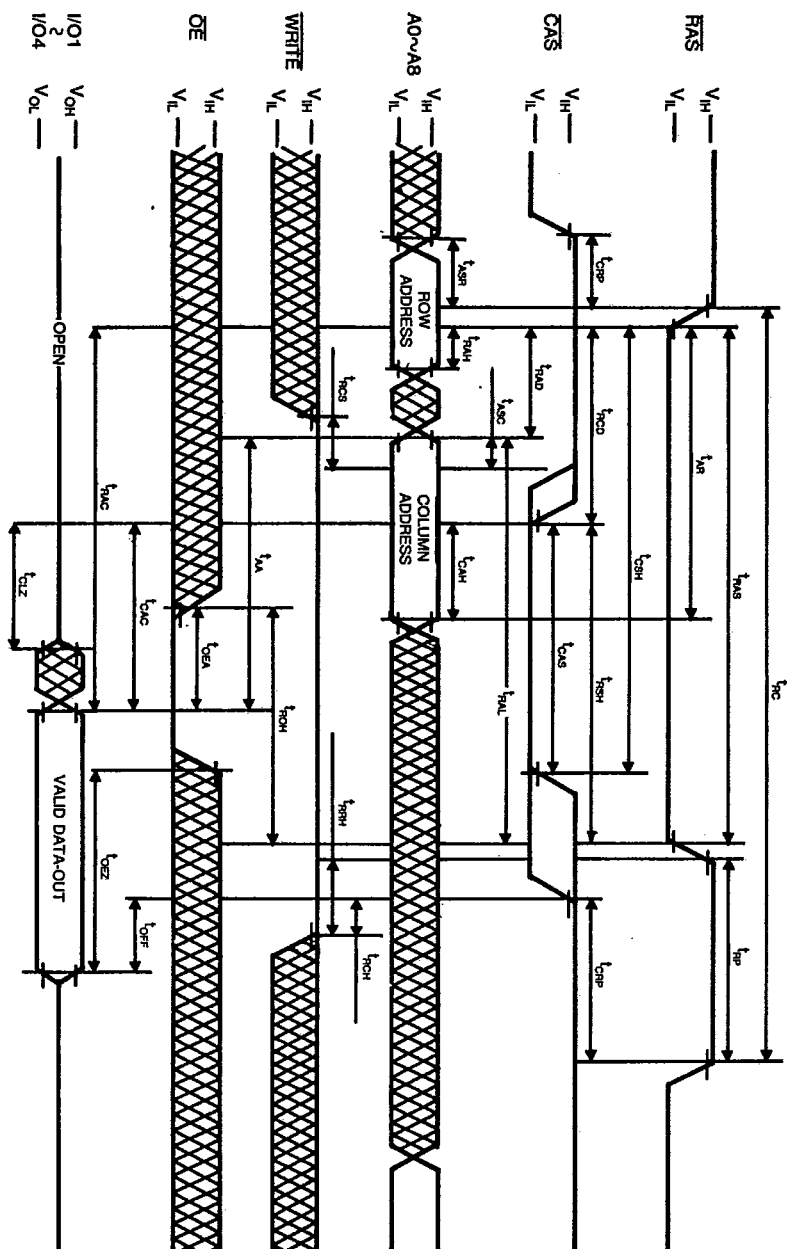


Figure 2. Read Cycle

GM71C4256

T-46-23-17

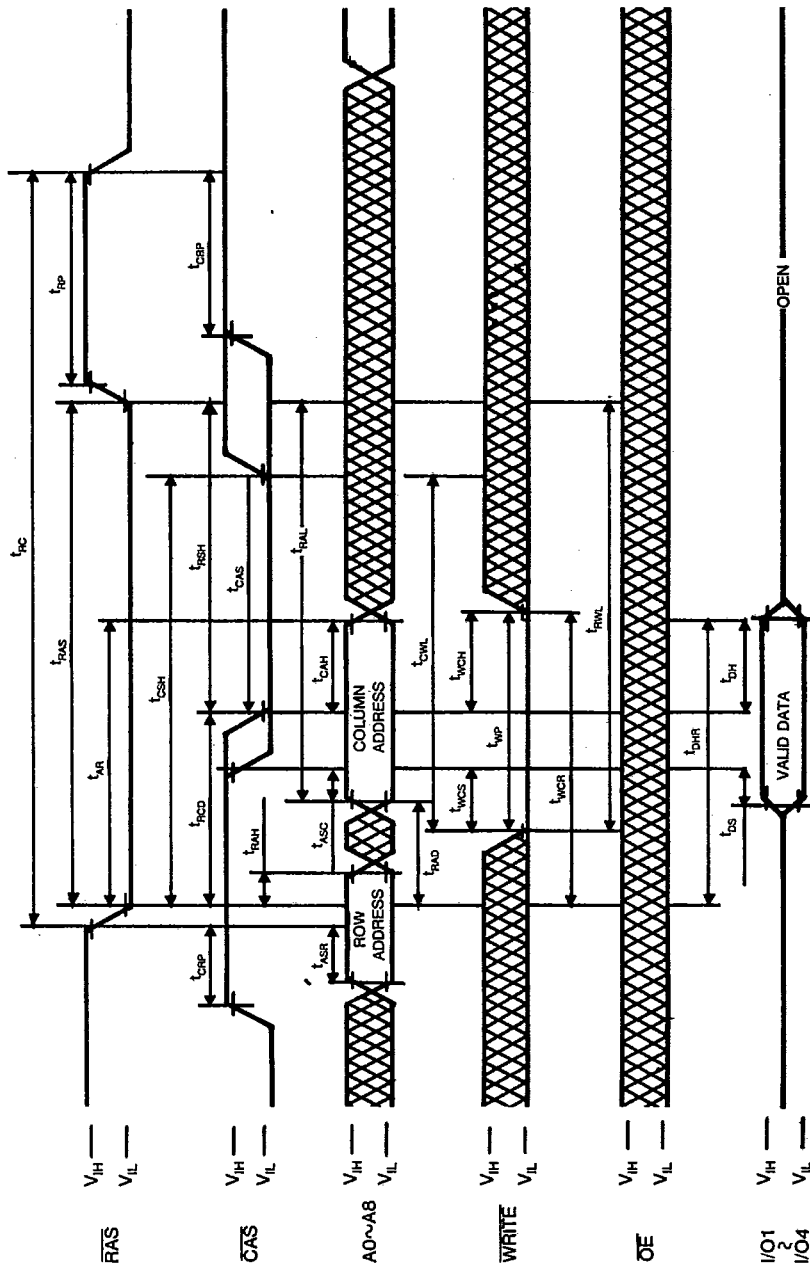


Figure 3. Write Cycle (Early Write)

GM71C4256

T-46-23-17

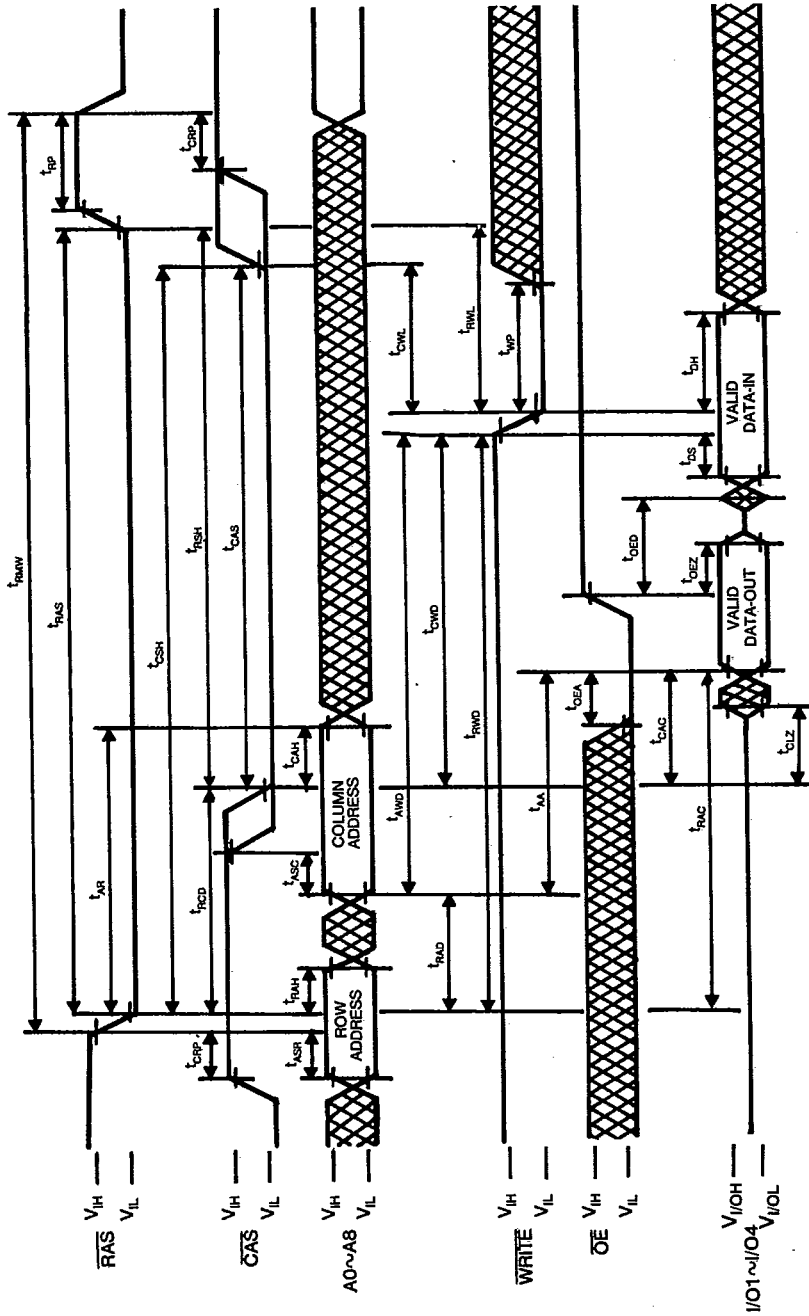


Figure 5. Read-Modify-Write Cycle

GM71C4256

T-46-23-17

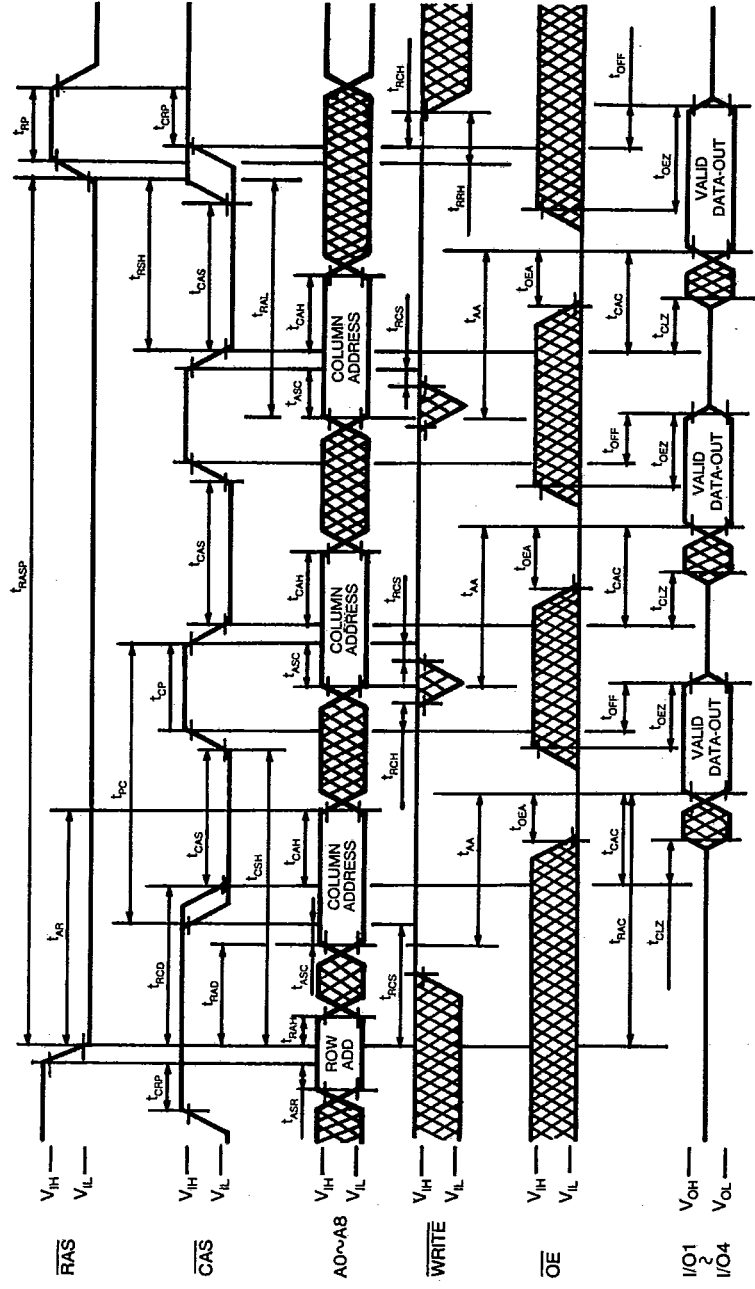


Figure 6. Fast Page Mode Read Cycle

GM71C4256

T-46-23-17

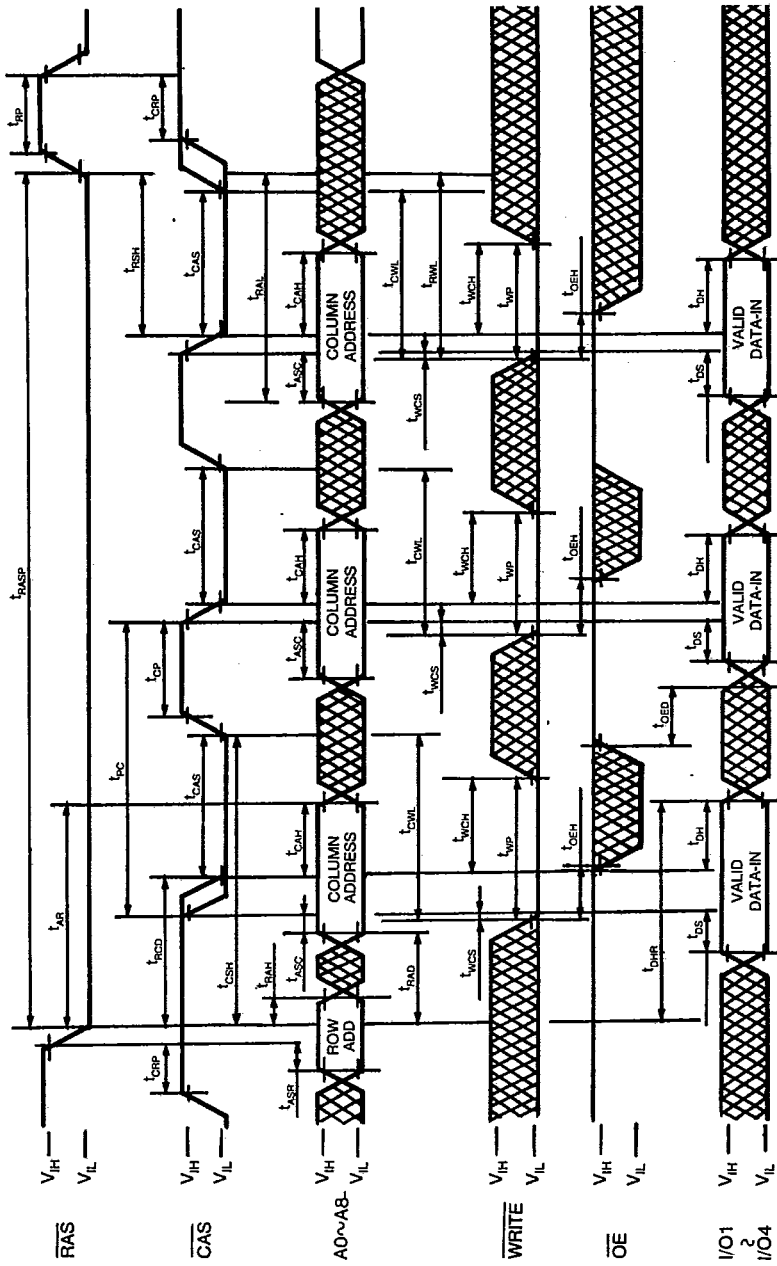


Figure 7. Fast Page Mode Write Cycle

GM71C4256

T-46-23-17

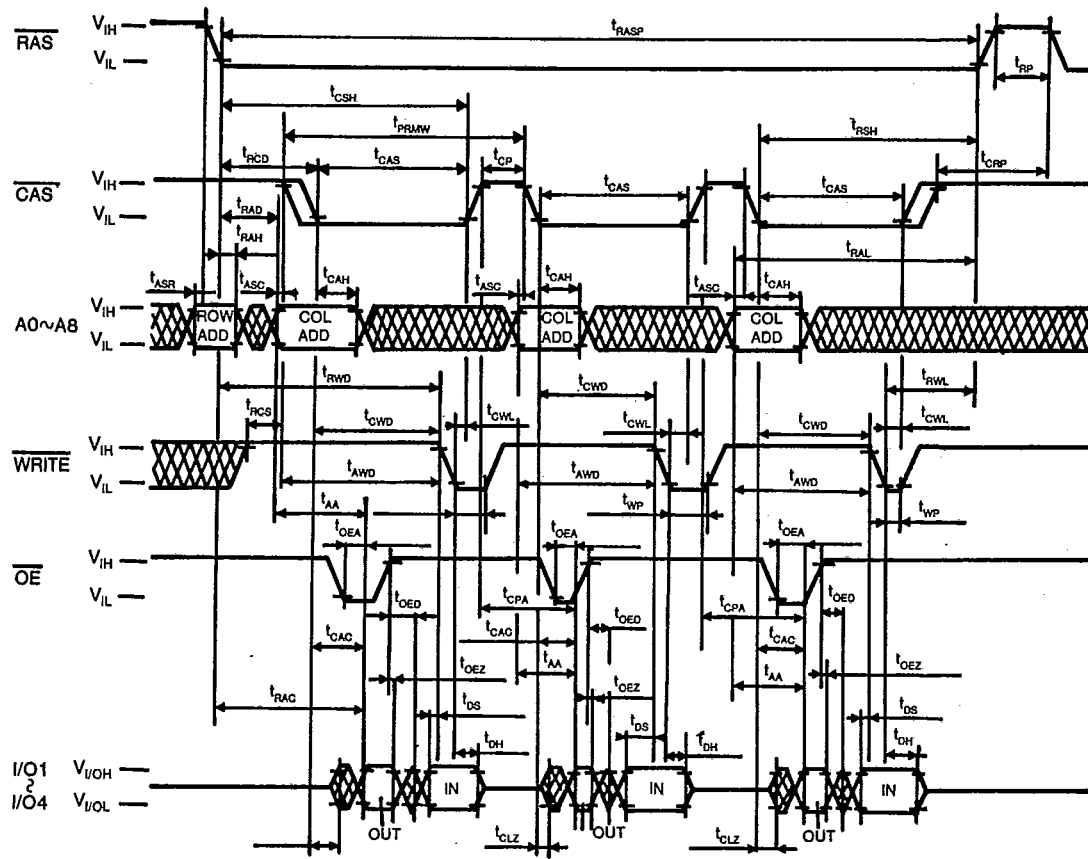
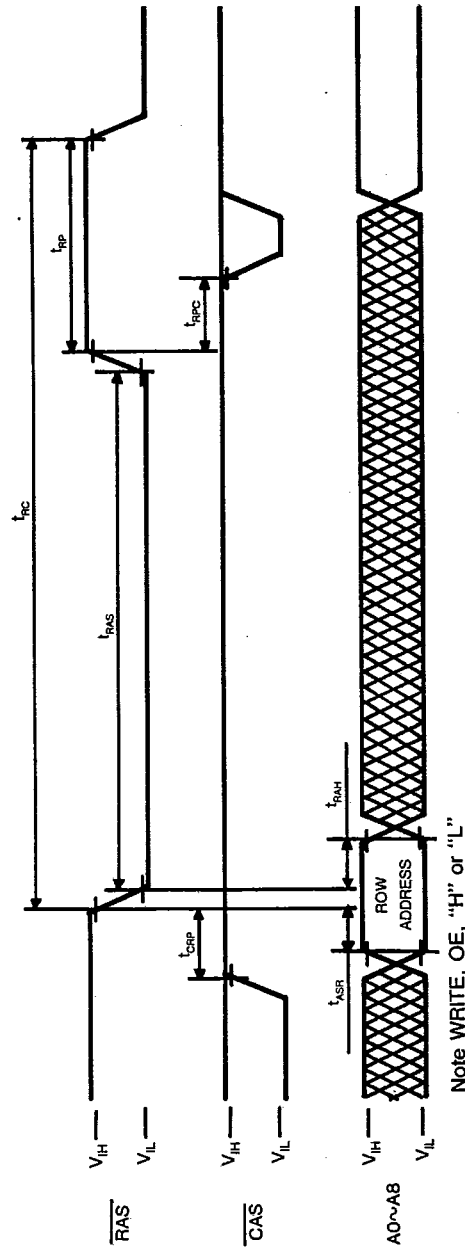


Figure 8. Fast Page Mode Read-Modify-Write Cycle

GM71C4256

T-46-23-17



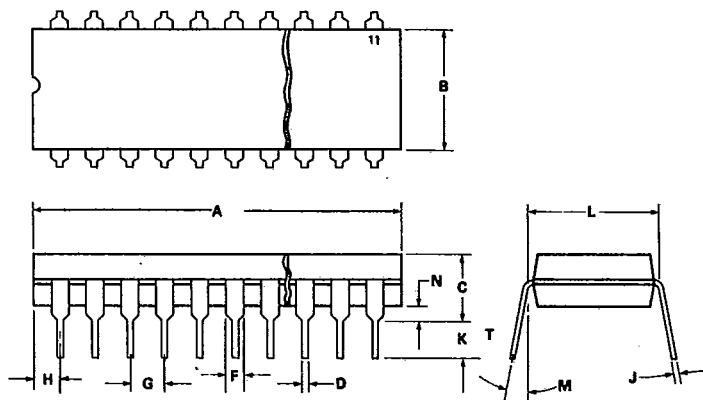
Note WRITE, OE, "H" or "L"

Figure 9. $\overline{\text{RAS}}$ Only Refresh Cycle

PACKAGE DIMENSION

PLASTIC DIP

T-90-20



(UNIT: INCHES)

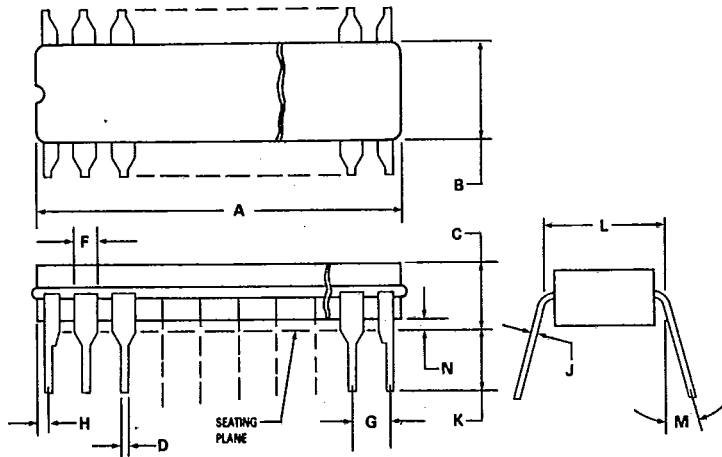
| SYMBOL | 16 PIN | | 18 PIN | | 20 PIN | | 22 PIN | |
|--------|------------|-------|------------|-------|------------|-------|------------|-------|
| | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| A | 0.738 | 0.752 | 0.875 | 0.900 | 1.013 | 1.040 | 1.095 | 1.150 |
| B | 0.245 | 0.255 | 0.245 | 0.255 | 0.263 | 0.273 | 0.260 | 0.287 |
| C | 0.143 | 0.152 | 0.145 | 0.162 | 0.143 | 0.152 | 0.145 | 0.160 |
| D | TYP. 0.018 | | TYP. 0.018 | | TYP. 0.018 | | TYP. 0.018 | |
| F | TYP. 0.063 | | TYP. 0.060 | | TYP. 0.065 | | TYP. 0.060 | |
| G | 0.09 | 0.11 | 0.09 | 0.11 | 0.09 | 0.11 | 0.09 | 0.11 |
| H | 0.015 | 0.030 | 0.04 | 0.05 | 0.058 | 0.066 | — | 0.075 |
| J | 0.009 | 0.014 | 0.009 | 0.015 | 0.009 | 0.010 | 0.009 | 0.010 |
| K | 0.125 | 0.145 | 0.125 | 0.130 | 0.125 | 0.132 | 0.125 | 0.142 |
| L | 0.300 BSC | | 0.300 BSC | | 0.300 BSC | | 0.300 BSC | |
| M | 0' | 10' | 0' | 10' | 0' | 10' | 0' | 10' |
| N | 0.015 | — | 0.015 | — | 0.015 | — | 0.015 | — |

| SYMBOL | 24 PIN | | 28 PIN | | | | | |
|--------|------------|-------|------------|-------|--|--|--|--|
| | MIN | MAX | MIN | MAX | | | | |
| A | 1.243 | 1.260 | 1.415 | 1.460 | | | | |
| B | 0.535 | 0.545 | 0.535 | 0.545 | | | | |
| C | 0.158 | 0.170 | 0.158 | 0.170 | | | | |
| D | TYP. 0.018 | | TYP. 0.018 | | | | | |
| F | TYP. 0.060 | | TYP. 0.060 | | | | | |
| G | 0.09 | 0.11 | 0.09 | 0.11 | | | | |
| H | 0.06 | 0.075 | 0.06 | 0.076 | | | | |
| J | 0.009 | 0.015 | 0.009 | 0.015 | | | | |
| K | 0.125 | 0.132 | 0.125 | 0.132 | | | | |
| L | 0.600 | 0.625 | 0.600 | 0.620 | | | | |
| M | 0' | 10' | 0' | 10' | | | | |
| N | 0.008 | — | 0.008 | — | | | | |

PACKAGE DIMENSION

T-90-20

CER DIP



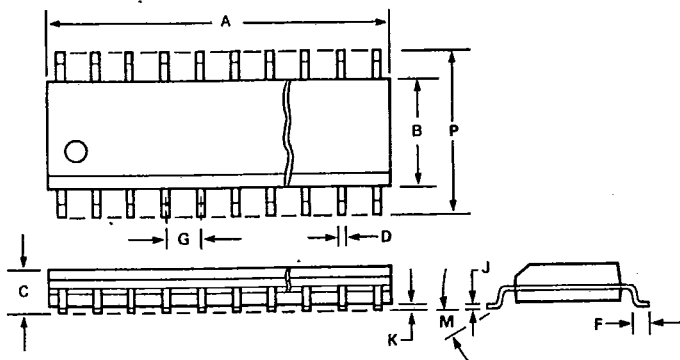
(UNIT : INCHES)

| SYMBOL | 16 PIN | | 20 PIN | | 24 PIN | | 28 PIN | |
|--------|--------|-------|--------|-------|--------|-------|--------|-------|
| | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX |
| A | 0.753 | 0.785 | 0.940 | 0.985 | 1.240 | 1.290 | 1.440 | 1.485 |
| B | 0.272 | 0.294 | 0.265 | 0.306 | 0.514 | 0.526 | 0.514 | 0.598 |
| C | 0.165 | 0.200 | 0.165 | 0.200 | 0.165 | 0.200 | | 0.225 |
| D | 0.015 | 0.021 | 0.015 | 0.021 | 0.015 | 0.021 | 0.015 | 0.023 |
| F | 0.055 | 0.065 | 0.055 | 0.065 | 0.055 | 0.065 | 0.055 | 0.065 |
| G | 0.09 | 0.11 | 0.09 | 0.11 | 0.09 | 0.11 | 0.09 | 0.11 |
| H | 0.012 | 0.060 | 0.012 | 0.060 | 0.040 | 0.098 | 0.040 | 0.098 |
| J | 0.008 | 0.012 | 0.008 | 0.012 | 0.008 | 0.012 | 0.008 | 0.012 |
| K | 0.125 | 0.20 | 0.125 | 0.20 | 0.125 | 0.20 | 0.125 | 0.20 |
| L | 0.29 | 0.32 | 0.29 | 0.32 | 0.590 | 0.620 | 0.590 | 0.620 |
| M | 0' | 10' | 0' | 10' | 0' | 10' | 0' | 10' |
| N | 0.02 | 0.06 | 0.02 | 0.07 | 0.02 | 0.07 | 0.02 | 0.07 |

PACKAGE DIMENSION

SOP

T-90-20



(UNIT : INCHES)

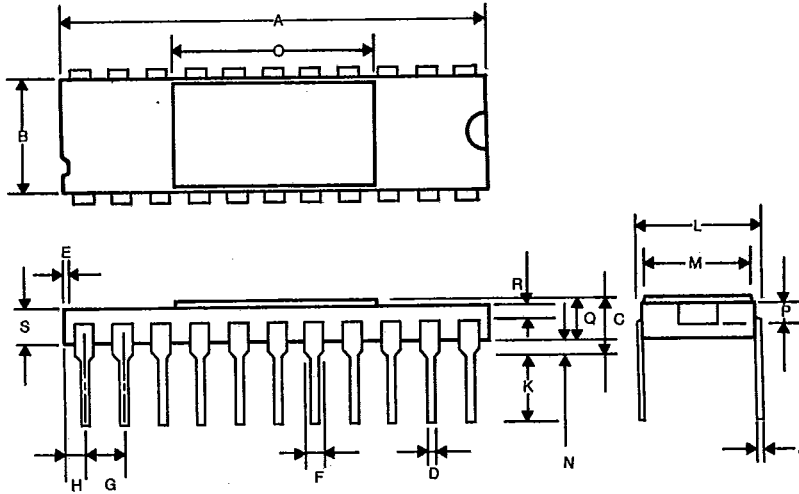
| CODE NO. PIN SYMBOL | 20 F | | 24 F | | 24 FW | | | |
|---------------------------|-----------|-------|-----------|--------|------------|-------|--|--|
| | 20 PIN | | 24 PIN | | 24 PIN | | | |
| | MIN | MAX | MIN | MAX | MIN | MAX | | |
| A | 0.496 | 0.510 | 0.602 | 0.614 | 0.622 | 0.638 | | |
| B | 0.292 | 0.299 | 0.292 | 0.299 | TYP. 0.331 | | | |
| C | 0.097 | 0.104 | 0.097 | 0.104 | — | 0.098 | | |
| D | 0.014 | 0.019 | 0.014 | 0.019 | 0.012 | 0.018 | | |
| F | 0.018 | 0.035 | 0.018 | 0.035 | TYP 0.039 | | | |
| G | 0.050 BSC | | 0.050 BSC | | 0.050 BSC | | | |
| J | 0.010 BSC | | 0.010 BSC | | 0.010 BSC | | | |
| K | 0.004 | 0.008 | 0.0055 | 0.0115 | 0.004 | | | |
| P | 0.400 | 0.410 | 0.400 | 0.410 | 0.453 | 0.477 | | |
| M | 0' | 8' | 0' | 8' | — | — | | |

| CODE NO. PIN SYMBOL | 28 F | | 28 FW | | | | | |
|---------------------------|-----------|--------|------------|-------|--|--|--|--|
| | 28 PIN | | 28 PIN | | | | | |
| | MIN | MAX | MIN | MAX | | | | |
| A | 0.703 | 0.712 | 0.720 | 0.750 | | | | |
| B | 0.292 | 0.289 | TYP. 0.331 | | | | | |
| C | 0.097 | 0.104 | | 0.098 | | | | |
| D | 0.014 | 0.019 | 0.012 | 0.018 | | | | |
| F | 0.018 | 0.035 | TYP. 0.039 | | | | | |
| G | 0.050 BSC | | 0.050 BSC | | | | | |
| J | 0.010 BSC | | 0.010 BSC | | | | | |
| K | 0.0055 | 0.0115 | 0.004 | — | | | | |
| P | 0.400 | 0.410 | 0.453 | 0.477 | | | | |
| M | 0' | 8' | — | — | | | | |

PACKAGE DIMENSION

SIDE BRAZED

T-90-20



(UNIT: INCHES)

| SYMBOL | 22 PIN | |
|--------|------------|-------|
| | MIN | MAX |
| A | 1.088 | 1.112 |
| B | 0.281 | 0.298 |
| C | — | 0.160 |
| D | 0.016 | 0.020 |
| E | 0.004 | — |
| F | TYP. 0.050 | |
| G | 0.09 | 0.105 |
| H | 0.035 | 0.065 |
| J | 0.009 | 0.011 |

| SYMBOL | 22 PIN | |
|--------|------------|-------|
| | MIN | MAX |
| K | 0.14 | 0.170 |
| L | 0.290 | 0.310 |
| M | 0.265 | 0.275 |
| N | 0.020 | 0.050 |
| O | 0.555 | 0.565 |
| P | TYP. 0.050 | |
| Q | 0.092 | 0.122 |
| R | 0.005 | — |
| S | 0.08 | — |