



512Kx32 5V FLASH MODULE, SMD 5962-94612

FEATURES

- Access Times of 60, 70, 90, 120, 150ns
- Packaging
 - 66 pin, PGA Type, 1.075" square, Hermetic Ceramic HIP (Package 400⁽¹⁾).
 - 68 lead, 40mm, Low Capacitance Hermetic CQFP (Package 501)¹
 - 68 lead, 40mm, Low Profile 3.5mm (0.140"), CQFP (Package 502)¹
 - 68 lead, 22.4mm (0.880") Low Profile CQFP (G2U) 3.5mm (0.140") high, (Package 510)¹
 - 68 lead, 22.4mm (0.880") CQFP (G2L) 5.08mm (0.200") high, Package (528)
- 1,000,000 Erase/Program Cycles Minimum
- Sector Architecture
 - 8 equal size sectors of 64KBytes each
 - Any combination of sectors can be concurrently erased. Also supports full chip erase
- Organized as 512Kx32
- Commercial, Industrial and Military Temperature Ranges
- 5 Volt Programming. 5V ± 10% Supply.
- Low Power CMOS, 6.5mA Standby
- Embedded Erase and Program Algorithms
- TTL Compatible Inputs and CMOS Outputs
- Built-in Decoupling Caps for Low Noise Operation
- Page Program Operation and Internal Program Control Time
- Weight
 - WF512K32 - XG2UX5 - 8 grams typical
 - WF512K32N - XH1X5 - 13 grams typical
 - WF512K32 - XG4TX5¹ - 20 grams typical
 - WF512K32-XG2LX5 - 8 grams typical

* This product is subject to change without notice.
 Note 1: Package Not Recommended for New Design
 See Flash Programming Application Note 4M5 for algorithms.

FIGURE 1 – PIN CONFIGURATION FOR WF512K32N-XH1X5

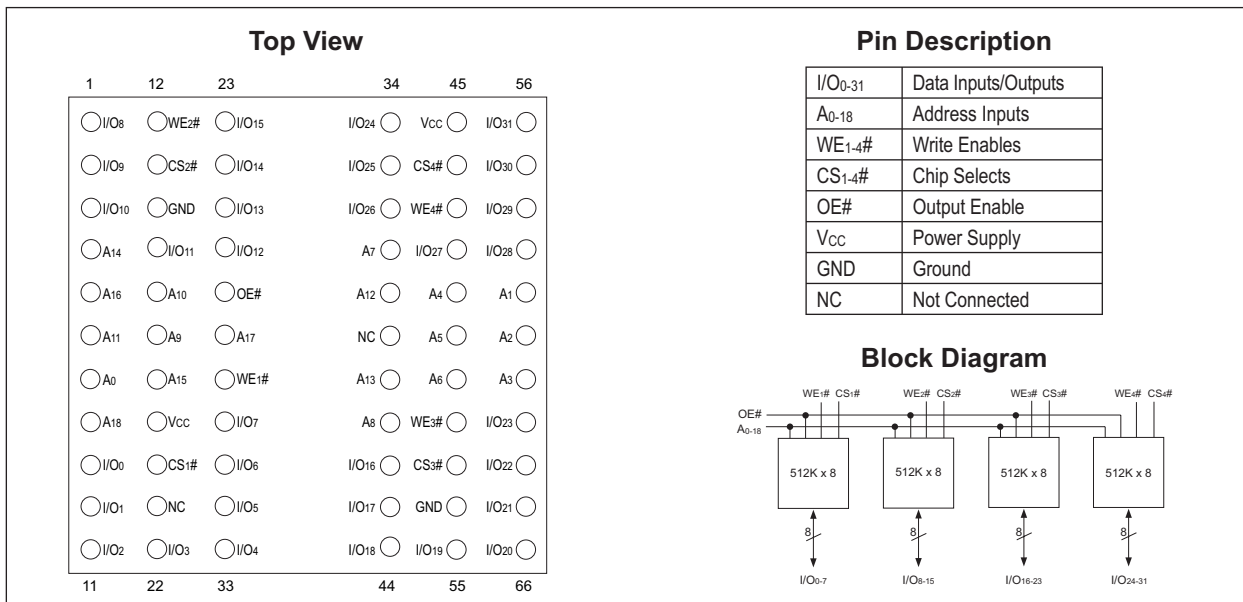




FIGURE 2 – PIN CONFIGURATION FOR WF512K32-XG4TX5¹

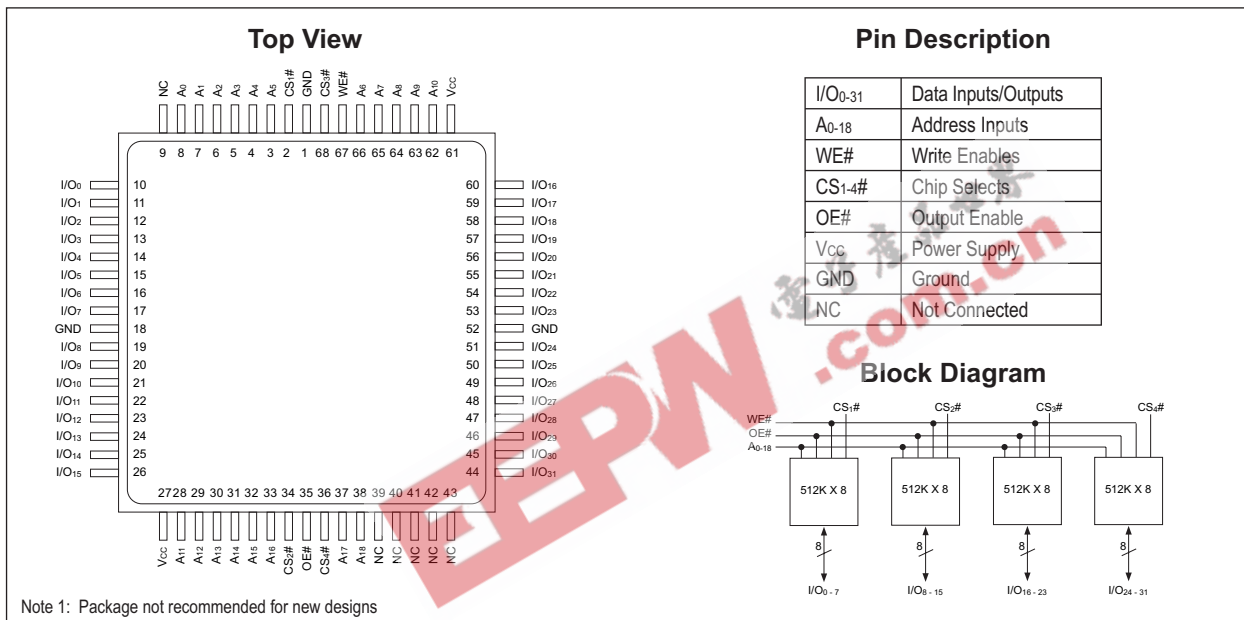
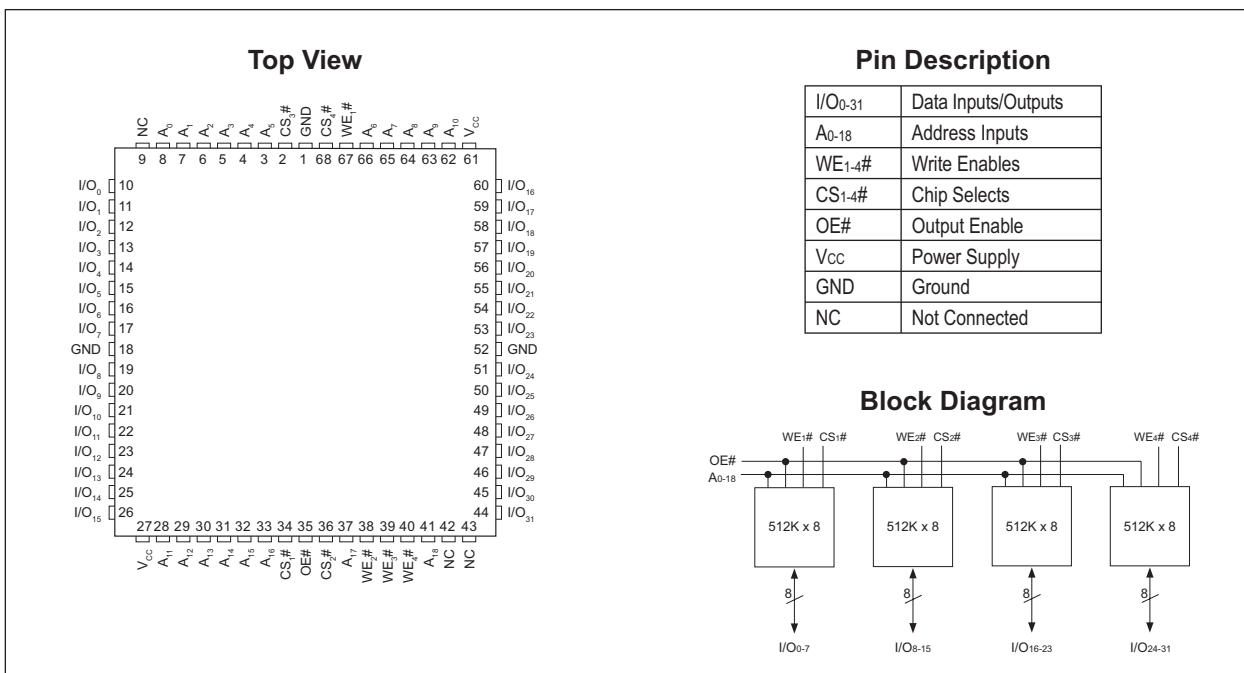


FIGURE 3 – PIN CONFIGURATION FOR WF512K32-XG2UX5 AND WF512K32-XG2LX5





Absolute Maximum Ratings (1)

| Parameter | | Unit |
|--|-----------------------|------|
| Operating Temperature | -55 to +125 | °C |
| Supply Voltage Range (V _{CC}) | -2.0 to +7.0 | V |
| Signal voltage range (any pin except A9) (2) | -2.0 to +7.0 | V |
| Storage Temperature Range | -65 to +150 | °C |
| Lead Temperature (soldering, 10 seconds) | +300 | °C |
| Data Retention (Mil Temp) | 20 years | |
| Endurance - write/erase cycles (Mil Temp) | 1,000,000 cycles min. | |
| A9 Voltage for sector protect (V _{ID}) (3) | -2.0 to +14.0 | V |

NOTES:

- Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.
- Minimum DC voltage on input or I/O pins is -0.5V. During voltage transitions, inputs may overshoot V_{SS} to -2.0 V for periods of up to 20ns. Maximum DC voltage on output and I/O pins is V_{CC} + 0.5V. During voltage transitions, outputs may overshoot to V_{CC} + 2.0 V for periods of up to 20ns.
- Minimum DC input voltage on A9 pin is -0.5V. During voltage transitions, A9 may overshoot V_{SS} to -2V for periods of up to 20ns. Maximum DC input voltage on A9 is +13.5V which may overshoot to 14.0 V for periods up to 20ns.

CAPACITANCE

T_A = +25°C

| Parameter | Symbol | Conditions | Max | Unit |
|------------------------------|------------------|------------------------------------|-----|------|
| OE# capacitance | C _{OE} | V _{IN} = 0V, f = 1.0 MHz | 50 | pF |
| WE1-4# capacitance HIP (PGA) | C _{WE} | V _{IN} = 0V, f = 1.0 MHz | 20 | pF |
| CQFP G4T | | | 50 | |
| CQFP G2U/G2L | | | 15 | |
| CS1-4# capacitance | C _{CS} | V _{IN} = 0V, f = 1.0 MHz | 20 | pF |
| Data# I/O capacitance | C _{I/O} | V _{I/O} = 0V, f = 1.0 MHz | 20 | pF |
| Address input capacitance | C _{AD} | V _{IN} = 0V, f = 1.0 MHz | 50 | pF |

This parameter is guaranteed by design but not tested.

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Min | Max | Unit |
|-------------------------------|-----------------|------|-----------------------|------|
| Supply Voltage | V _{CC} | 4.5 | 5.5 | V |
| Input High Voltage | V _{IH} | 2.0 | V _{CC} + 0.5 | V |
| Input Low Voltage | V _{IL} | -0.5 | +0.8 | V |
| Operating Temp. (Mil.) | T _A | -55 | +125 | °C |
| Operating Temp. (Ind.) | T _A | -40 | +85 | °C |
| A9 Voltage for Sector Protect | V _{ID} | 11.5 | 12.5 | V |

DC CHARACTERISTICS

V_{CC} = 5.0V, V_{SS} = 0V, -55°C ≤ T_A ≤ +125°C

| Parameter | Sym | Conditions | Min | Max | Units |
|---|--------------------|---|------------------------|------|-------|
| Input Leakage Current | I _{LI} | V _{CC} = 5.5, V _{IN} = GND to V _{CC} | | 10 | μA |
| Output Leakage Current | I _{LOx32} | CS# = V _{IH} , OE# = V _{IH} , V _{OUT} = GND to V _{CC} | | 10 | μA |
| V _{CC} Active Current for Read (1) | I _{CC1} | CS# = V _{IL} , OE# = V _{IH} , f = 5MHz, V _{CC} = 5.5 | | 190 | mA |
| V _{CC} Active Current for Program or Erase (2) | I _{CC2} | CS# = V _{IH} , OE# = V _{IH} | | 240 | mA |
| V _{CC} Standby Current | I _{CC4} | V _{CC} = 5.5, CS = V _{IH} , f = 5MHz | | 6.5 | mA |
| V _{CC} Static Current | I _{CC3} | V _{CC} = 5.5, CS = V _{IH} | | 0.6 | mA |
| Output Low Voltage | V _{OL} | I _{OL} = 8.0mA, V _{CC} = 4.5 | | 0.45 | V |
| Output High Voltage | V _{OH1} | I _{OH} = 2.5mA, V _{CC} = 4.5 | 0.85 x V _{CC} | | V |
| Low V _{CC} Lock-Out Voltage | V _{LKO} | | 3.2 | 4.2 | V |

DC test conditions: V_{IL} = 0.3V, V_{IH} = V_{CC} - 0.3V

NOTES:

- The I_{CC} current listed includes both the DC operating current and the frequency dependent component (at 5 MHz). The frequency component typically is less than 2 mA/MHz, with OE at V_{IH}.
- I_{CC} active while Embedded Algorithm (program or erase) is in progress.



AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS, CS# CONTROLLED

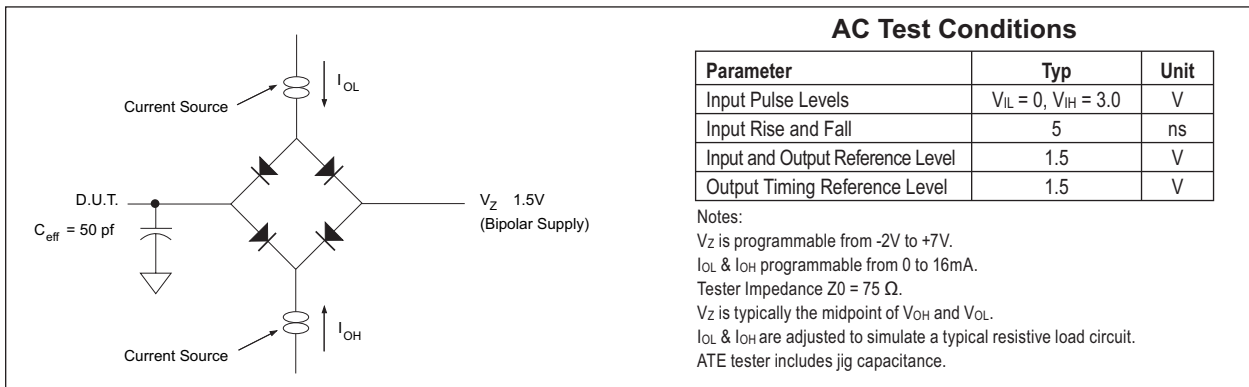
$V_{CC} = 5.0V, GND = 0V, -55^{\circ}C \leq T_A \leq +125^{\circ}C$

| Parameter | Symbol | | -60 | | -70 | | -90 | | -120 | | -150 | | Unit |
|--|-------------|-----------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|---------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | |
| Write Cycle Time | t_{AVAV} | t_{WC} | 60 | | 70 | | 90 | | 120 | | 150 | | ns |
| Write Enable Setup Time | t_{WLEL} | t_{WS} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Chip Select Pulse Width | t_{LELH} | t_{CP} | 40 | | 45 | | 45 | | 50 | | 50 | | ns |
| Address Setup Time | t_{AVEL} | t_{AS} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Data Setup Time | t_{DVEH} | t_{DS} | 40 | | 45 | | 45 | | 50 | | 50 | | ns |
| Data Hold Time | t_{EHDX} | t_{DH} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Address Hold Time | t_{ELAX} | t_{AH} | 40 | | 45 | | 45 | | 50 | | 50 | | ns |
| Chip Select Pulse Width High | t_{EHEL} | t_{CPH} | 20 | | 20 | | 20 | | 20 | | 20 | | ns |
| Duration of Byte Programming Operation (1) | t_{WHWH1} | | | 300 | | 300 | | 300 | | 300 | | 300 | μ s |
| Sector Erase Time (2) | t_{WHWH2} | | | 15 | | 15 | | 15 | | 15 | | 15 | sec |
| Read Recovery Time | t_{GHLEL} | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Chip Programming Time | | | | 11 | | 11 | | 11 | | 11 | | 11 | sec |
| Chip Erase Time (3) | | | | 64 | | 64 | | 64 | | 64 | | 64 | sec |

NOTES:

1. Typical value for t_{WHWH1} is 7 μ s.
2. Typical value for t_{WHWH2} is 1sec.
3. Typical value for Chip Erase Time is 8sec.

FIGURE 4 – AC TEST CIRCUIT





AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS, WE# CONTROLLED

V_{CC} = 5.0V, GND = 0V, -55°C ≤ T_A ≤ +125°C

| Parameter | Symbol | | -60 | | -70 | | -90 | | -120 | | -150 | | Unit |
|--|--------------------|------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | |
| Write Cycle Time | t _{AVAV} | t _{WC} | 60 | | 70 | | 90 | | 120 | | 150 | | ns |
| Chip Select Setup Time | t _{ELWL} | t _{CS} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Write Enable Pulse Width | t _{WLWH} | t _{WP} | 40 | | 45 | | 45 | | 50 | | 50 | | ns |
| Address Setup Time | t _{AVWH} | t _{AS} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Data Setup Time | t _{DVWH} | t _{DS} | 40 | | 45 | | 45 | | 50 | | 50 | | ns |
| Data Hold Time | t _{WHDX} | t _{DH} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Address Hold Time | t _{WHAX} | t _{AH} | 40 | | 45 | | 45 | | 50 | | 50 | | ns |
| Write Enable Pulse Width High | t _{WHWL} | t _{WPH} | 20 | | 20 | | 20 | | 20 | | 20 | | ns |
| Duration of Byte Programming Operation (1) | t _{WHWH1} | | | 300 | | 300 | | 300 | | 300 | | 300 | μs |
| Sector Erase Time (2) | t _{WHWH2} | | | 15 | | 15 | | 15 | | 15 | | 15 | sec |
| Read Recovery Time before Write | t _{GHWL} | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| VCC Set-up Time | t _{VCS} | | 50 | | 50 | | 50 | | 50 | | 50 | | μs |
| Chip Programming Time | | | | 11 | | 11 | | 11 | | 11 | | 11 | sec |
| Output Enable Setup Time | t _{OES} | | 0 | | 0 | | 0 | | 0 | | 0 | | ns |
| Output Enable Hold Time (4) | t _{OEH} | | 10 | | 10 | | 10 | | 10 | | 10 | | ns |
| Chip Erase Time (3) | | | | 64 | | 64 | | 64 | | 64 | | 64 | sec |

NOTES:

1. Typical value for t_{WHWH1} is 7μs.
2. Typical value for t_{WHWH2} is 1sec.
3. Typical value for Chip Erase Time is 8sec.
4. For Toggle and Data Polling.

AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS, WE# CONTROLLED

V_{CC} = 5.0V, -55°C ≤ T_A ≤ +125°C

| Parameter | Symbol | | -60 | | -70 | | -90 | | -120 | | -150 | | Unit |
|---|-------------------|------------------|-----|-----|-----|-----|-----|-----|------|-----|------|-----|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | |
| Read Cycle Time | t _{AVAV} | t _{RC} | 60 | | 70 | | 90 | | 120 | | 150 | | ns |
| Address Access Time | t _{AVOV} | t _{ACC} | | 60 | | 70 | | 90 | | 120 | | 150 | ns |
| Chip Select Access Time | t _{ELQV} | t _{CE} | | 60 | | 70 | | 90 | | 120 | | 150 | ns |
| Output Enable to Output Valid | t _{GLQV} | t _{OE} | | 30 | | 35 | | 35 | | 50 | | 55 | ns |
| Chip Select to Output High Z (1) | t _{EHQZ} | t _{DF} | | 20 | | 20 | | 20 | | 30 | | 35 | ns |
| Output Enable High to Output High Z (1) | t _{GHQZ} | t _{DF} | | 20 | | 20 | | 20 | | 30 | | 35 | ns |
| Output Hold from Address, CS# or OE# Change, whichever is First | t _{AXQX} | t _{OH} | 0 | | 0 | | 0 | | 0 | | 0 | | ns |

1. Guaranteed by design, but not tested



FIGURE 5 – AC WAVEFORMS FOR READ OPERATIONS

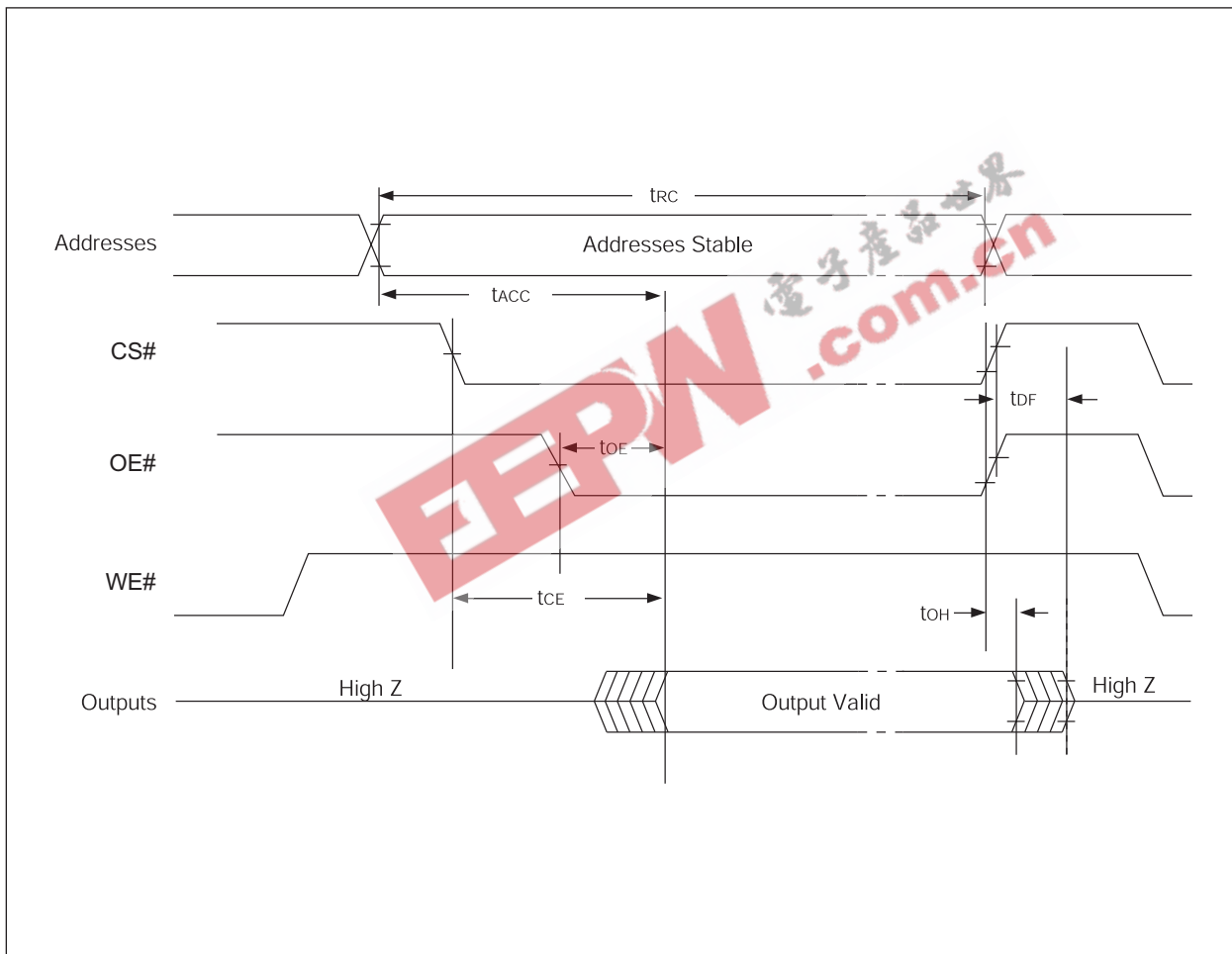




FIGURE 6 – WRITE/ERASE/PROGRAM OPERATION, WE# CONTROLLED

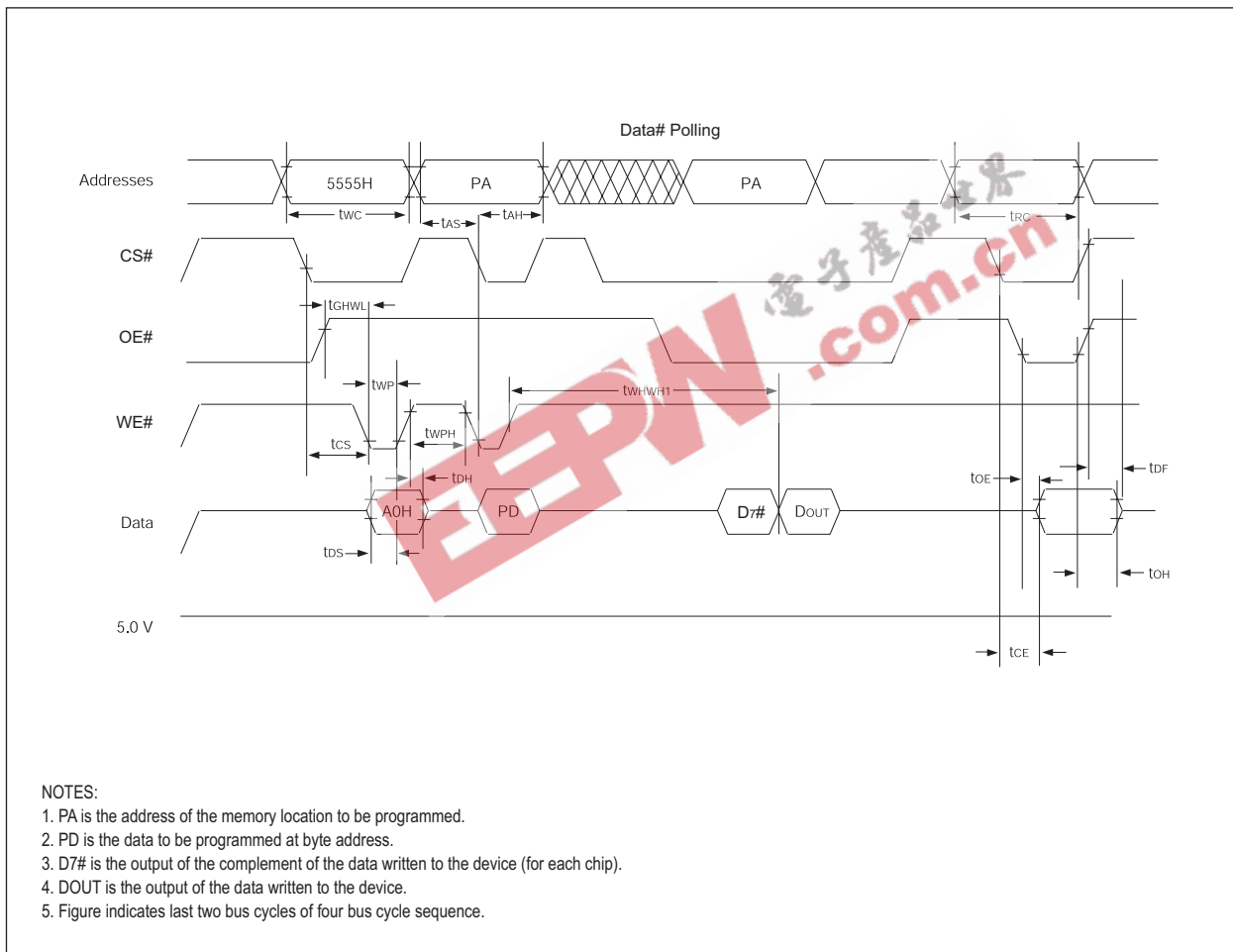




FIGURE 7 – AC WAVEFORMS CHIP/SECTOR ERASE OPERATIONS

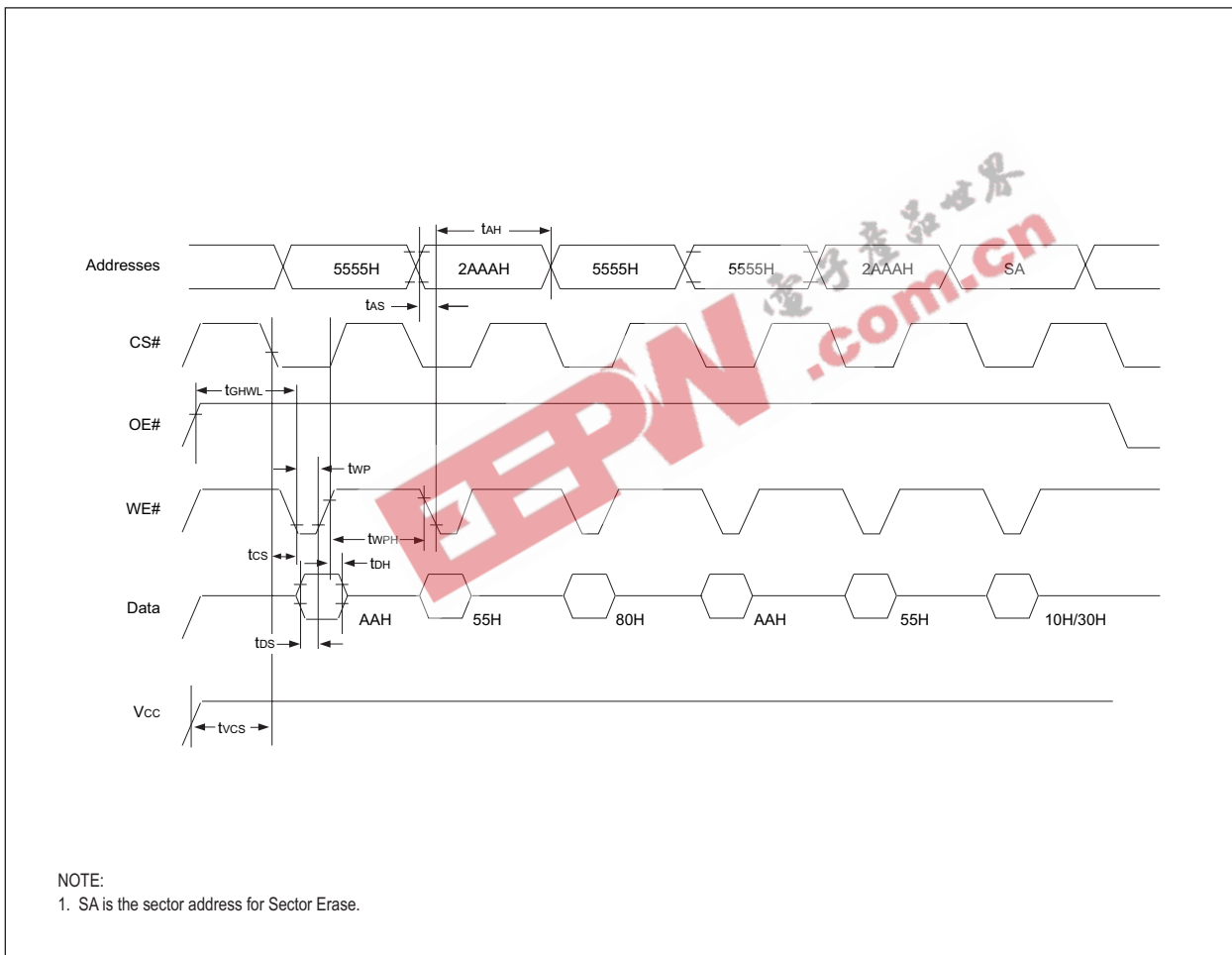




FIGURE 8 – AC WAVEFORMS FOR DATA# POLLING DURING EMBEDDED ALGORITHM OPERATIONS

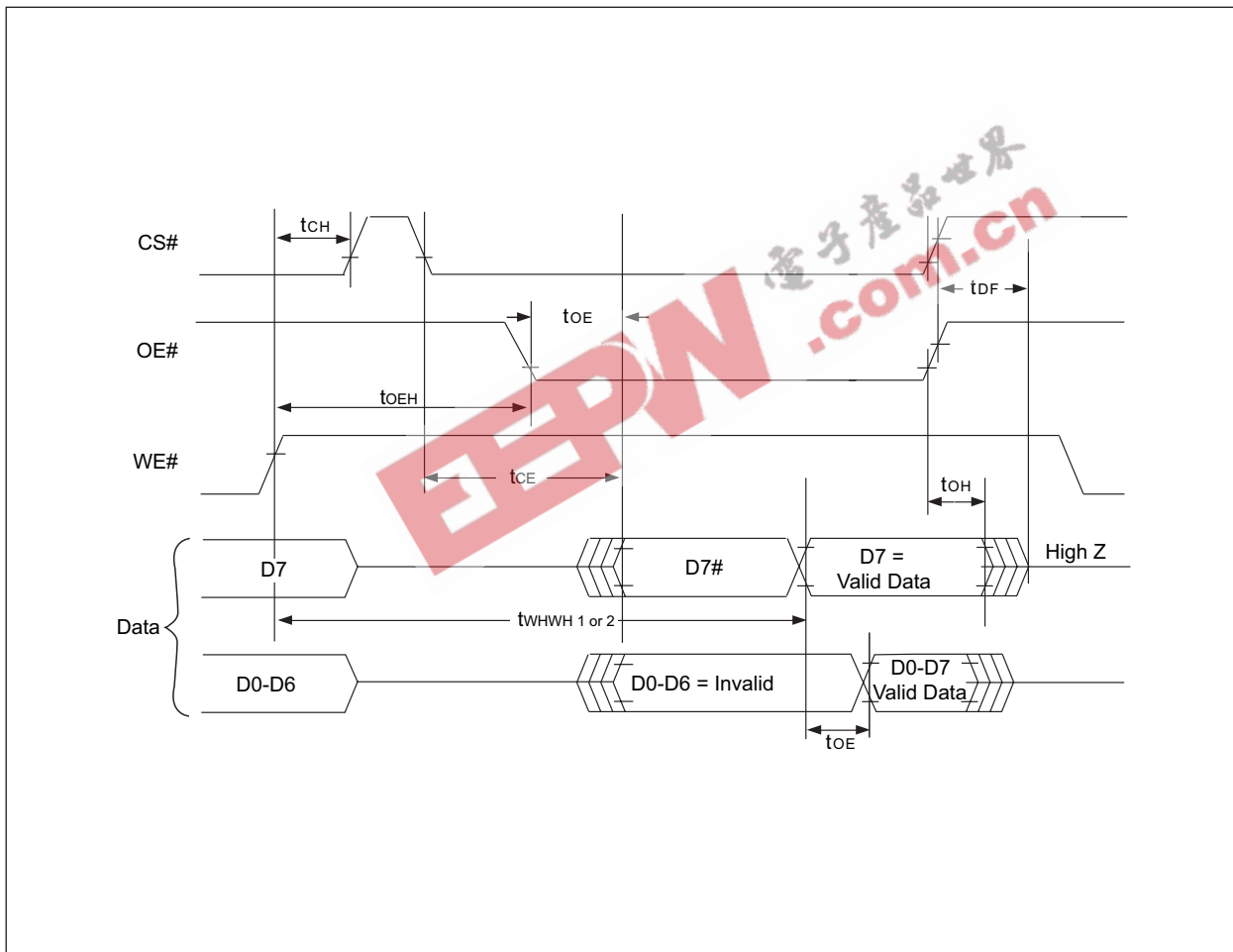
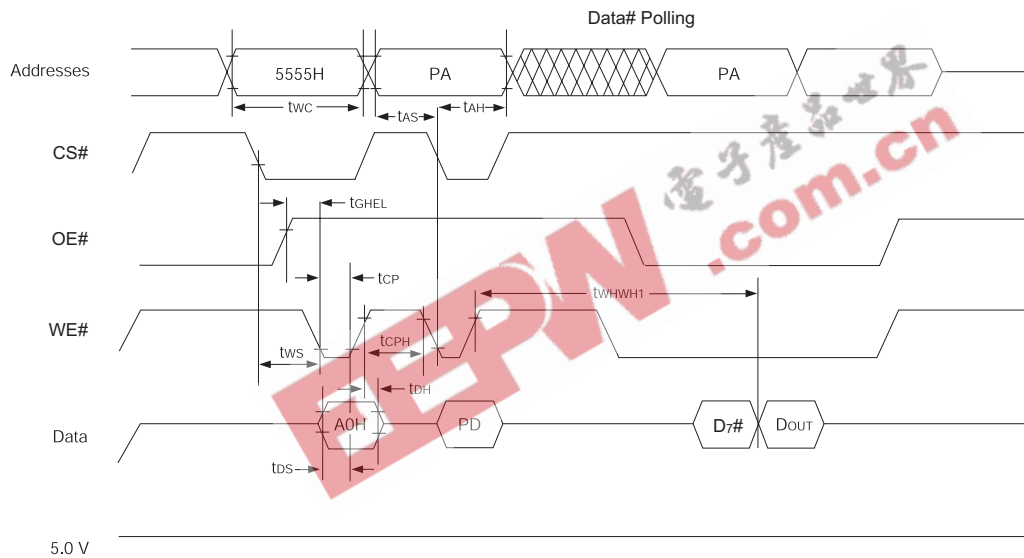




FIGURE 9 – ALTERNATE CS# CONTROLLED PROGRAMMING OPERATION TIMINGS

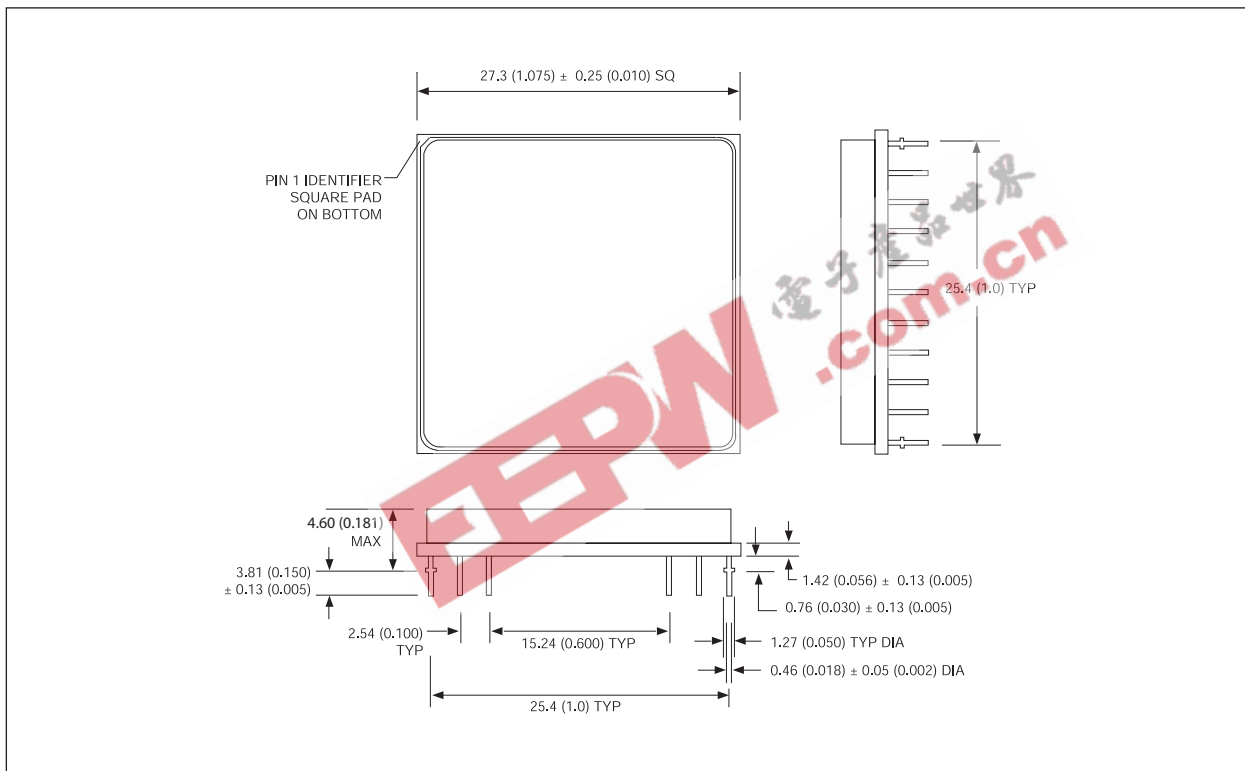


Notes:

1. PA represents the address of the memory location to be programmed.
2. PD represents the data to be programmed at byte address.
3. D7# is the output of the complement of the data written to the device (for each chip).
4. DOUT is the output of the data written to the device.
5. Figure indicates the last two bus cycles of a four bus cycle sequence.



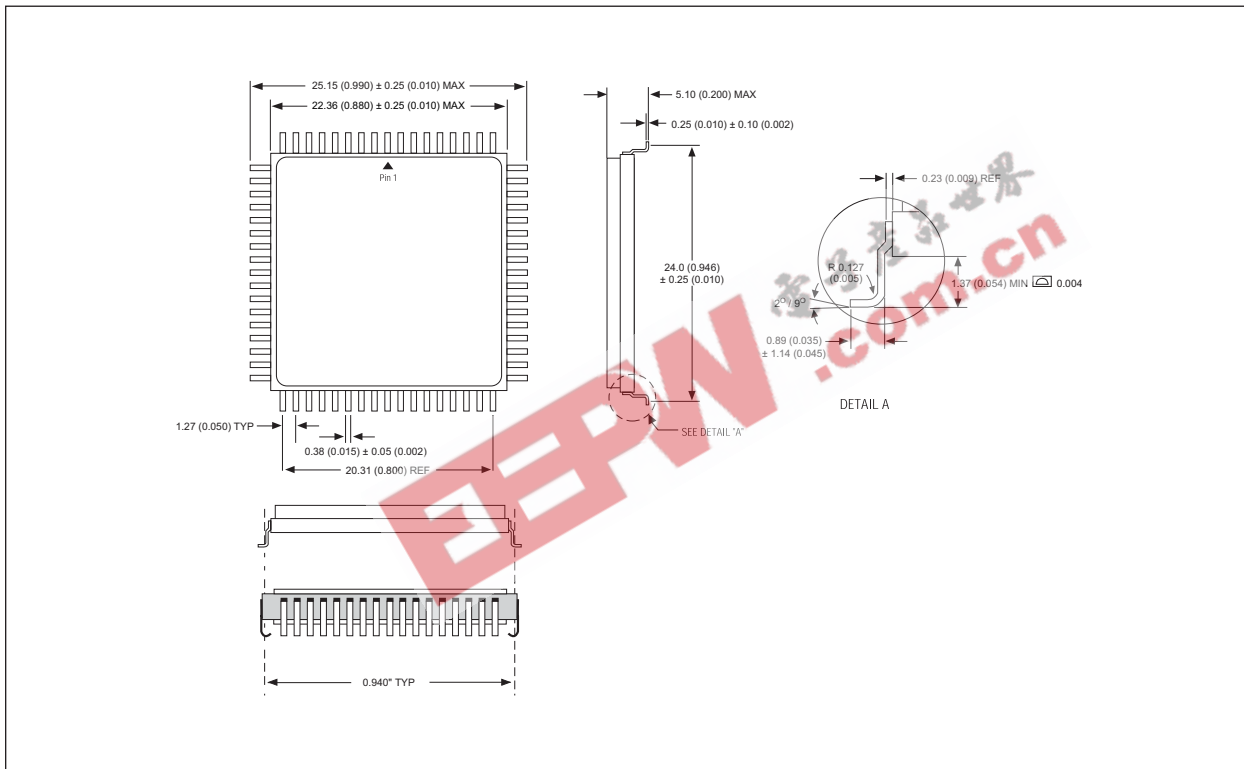
PACKAGE 400: 66 PIN, PGA TYPE, CERAMIC HEX-IN-LINE PACKAGE, HIP (H1)



ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES



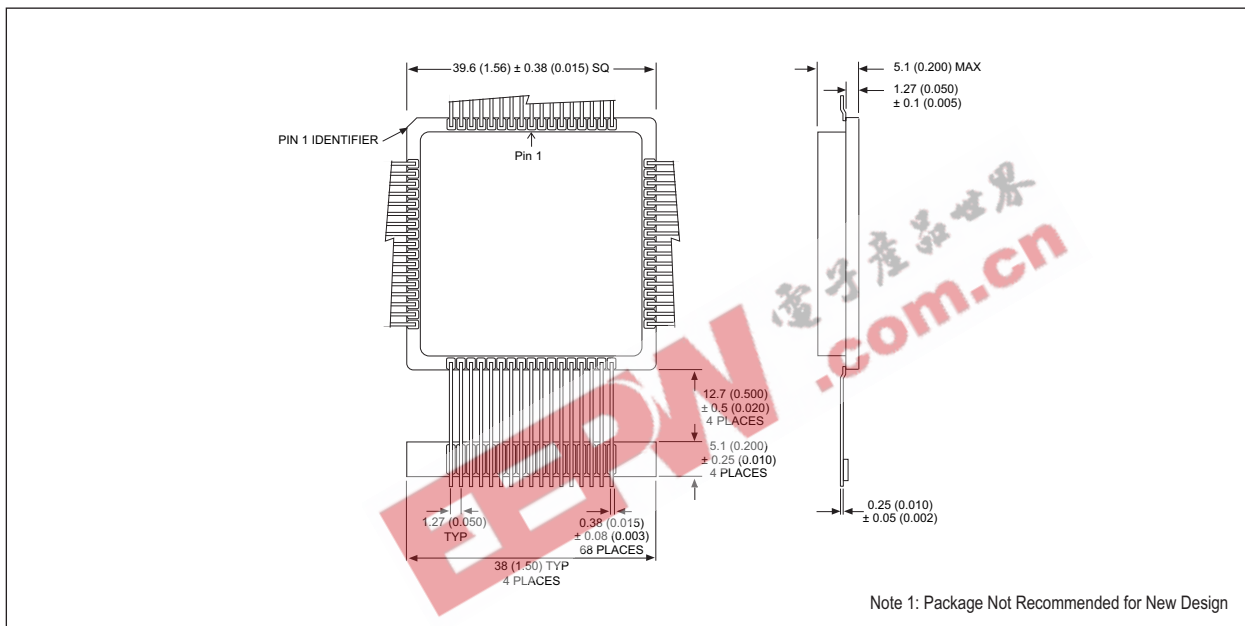
PACKAGE 528: 68 LEAD, CERAMIC QUAD FLAT PACK, CQFP (G2L)



ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES



PACKAGE 502: 68 LEAD, CERAMIC QUAD FLAT PACK, LOW PROFILE CQFP (G4T)¹



ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES



ORDERING INFORMATION

W F 512K32 X - XXX X X 5 X

LEAD FINISH:

- Blank = Gold plated leads
- A = Solder dip leads

V_{PP} PROGRAMMING VOLTAGE

5 = 5 V

DEVICE GRADE:

- Q = MIL-STD-883 Compliant
- M = Military Screened -55°C to +125°C
- I = Industrial -40°C to +85°C
- C = Commercial 0°C to +70°C

PACKAGE TYPE:

- H1 = 1.075" sq. Ceramic Hex In Line Package, HIP (Package 400*)
- G2U = 22.4mm Ceramic Quad Flat Pack, Low Profile CQFP (Package 510)
- G2L = 22.4mm Ceramic Quad Flat Pack, CQFP (Package 528)
- G4T¹ = 40mm Low Profile CQFP (Package 502)

ACCESS TIME (ns)

IMPROVEMENT MARK

N = No Connect at pins 21 and 39 in HIP for Upgrade

ORGANIZATION, 512K x 32

User configurable as 1M x 16 or 2M x 8

FLASH

WHITE ELECTRONIC DESIGNS CORP.

Note 1: Package Not Recommended for New Design



| DEVICE TYPE | SPEED | PACKAGE | SMD NO. |
|------------------------|-------|---|-------------------------------|
| 512K x 32 Flash Module | 150ns | 66 pin HIP (H1) 1.075" sq. | 5962-94612 01H4X |
| 512K x 32 Flash Module | 120ns | 66 pin HIP (H1) 1.075" sq. | 5962-94612 02H4X |
| 512K x 32 Flash Module | 90ns | 66 pin HIP (H1) 1.075" sq. | 5962-94612 03H4X |
| 512K x 32 Flash Module | 70ns | 66 pin HIP (H1) 1.075" sq. | 5962-94612 04H4X |
| 512K x 32 Flash Module | 150ns | 68 lead CQFP Low Profile (G4T) ¹ | 5962-94612 01HTX ¹ |
| 512K x 32 Flash Module | 120ns | 68 lead CQFP Low Profile (G4T) ¹ | 5962-94612 02HTX ¹ |
| 512K x 32 Flash Module | 90ns | 68 lead CQFP Low Profile (G4T) ¹ | 5962-94612 03HTX ¹ |
| 512K x 32 Flash Module | 70ns | 68 lead CQFP Low Profile (G4T) ¹ | 5962-94612 04HTX ¹ |
| 512K x 32 Flash Module | 150ns | 68 lead CQFP/J (G2U) | 5962-94612 01HZX |
| 512K x 32 Flash Module | 120ns | 68 lead CQFP/J (G2U) | 5962-94612 02HZX |
| 512K x 32 Flash Module | 90ns | 68 lead CQFP/J (G2U) | 5962-94612 03HZX |
| 512K x 32 Flash Module | 70ns | 68 lead CQFP/J (G2U) | 5962-94612 04HZX |
| 512K x 32 Flash Module | 150ns | 68 lead CQFP (G2L) | 5962-94612 01HAX |
| 512K x 32 Flash Module | 120ns | 68 lead CQFP (G2L) | 5962-94612 02HAX |
| 512K x 32 Flash Module | 90ns | 68 lead CQFP (G2L) | 5962-94612 03HAX |
| 512K x 32 Flash Module | 70ns | 68 lead CQFP (G2L) | 5962-94612 04HAX |