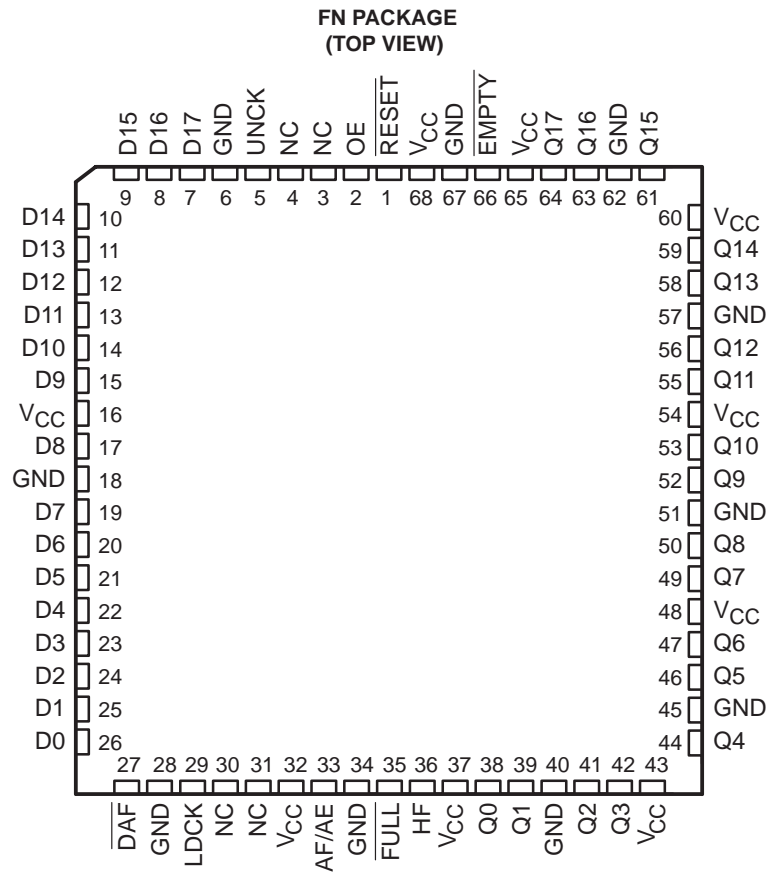


SN74ACT7802

1024 × 18 STROBED FIRST-IN, FIRST-OUT MEMORY

SCAS187D – AUGUST 1990 – REVISED APRIL 1998

- Member of the Texas Instruments Widebus™ Family
- Low-Power Advanced CMOS Technology
- Load and Unload Clocks Can Be Asynchronous or Coincident
- 1024 Words × 18 Bits
- Programmable Almost-Full/Almost-Empty Flag
- Empty, Full, and Half-Full Flags
- Fast Access Times of 30 ns With a 50-pF Load
- Fall-Through Time Is 20 ns Typical
- Data Rates up to 40 MHz
- High-Output Drive for Direct Bus Interface
- 3-State Outputs
- Package Options Include 68-Pin (FN) and 80-Pin Thin Quad Flat (PN) Packages



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Widebus is a trademark of Texas Instruments Incorporated.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



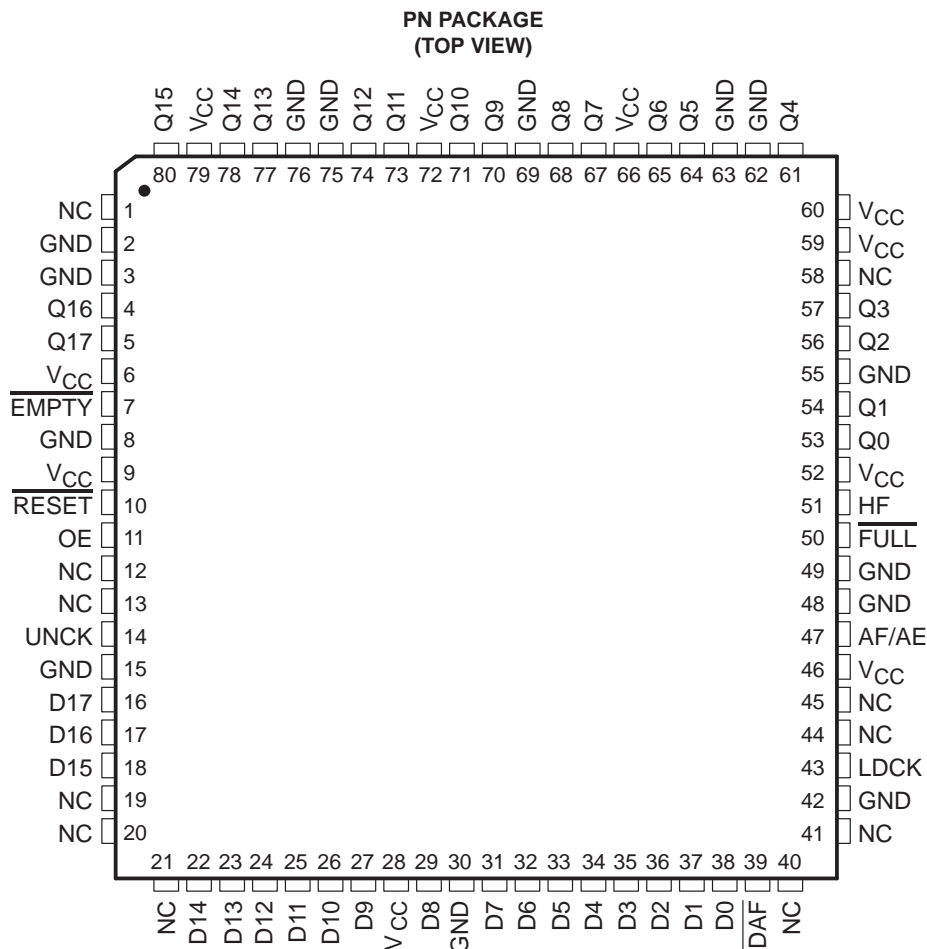
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SN74ACT7802

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NC – No internal connection

description

A FIFO memory is a storage device that allows data to be written into and read from its array at independent data rates. The SN74ACT7802 is a 1024-word by 18-bit FIFO for high-speed applications. It processes data in a bit-parallel format at rates up to 40 MHz and access times of 30 ns.

Data is written into the FIFO memory on a low-to-high transition on the load-clock (LDCK) input and is read out on a low-to-high transition on the unload-clock (UNCK) input. The memory is full when the number of words clocked in exceeds by 1024 the number of words clocked out. When the memory is full, LDCK has no effect on the data in the memory; when the memory is empty, UNCK has no effect.

A low level on the reset ($\overline{\text{RESET}}$) input resets the FIFO internal clock stack pointers and sets full ($\overline{\text{FULL}}$) high, almost full/almost empty (AF/AE) high, half full (HF) low, and empty ($\overline{\text{EMPTY}}$) low. The Q outputs are not reset to any specific logic level. The FIFO must be reset upon power up. The Q outputs are noninverting and are in the high-impedance state when the output-enable (OE) input is low.

When writing to the FIFO after a reset pulse or when the FIFO is empty, the first active transition on LDCK drives $\overline{\text{EMPTY}}$ high and causes the first word written to the FIFO to appear on the Q outputs. An active transition on UNCK is not required to read the first word written to the FIFO. Each subsequent read from the FIFO requires an active transition on UNCK.

The SN74ACT7802 can be cascaded in the word-width direction but not in the word-depth direction.

The SN74ACT7802 is characterized for operation from 0°C to 70°C.



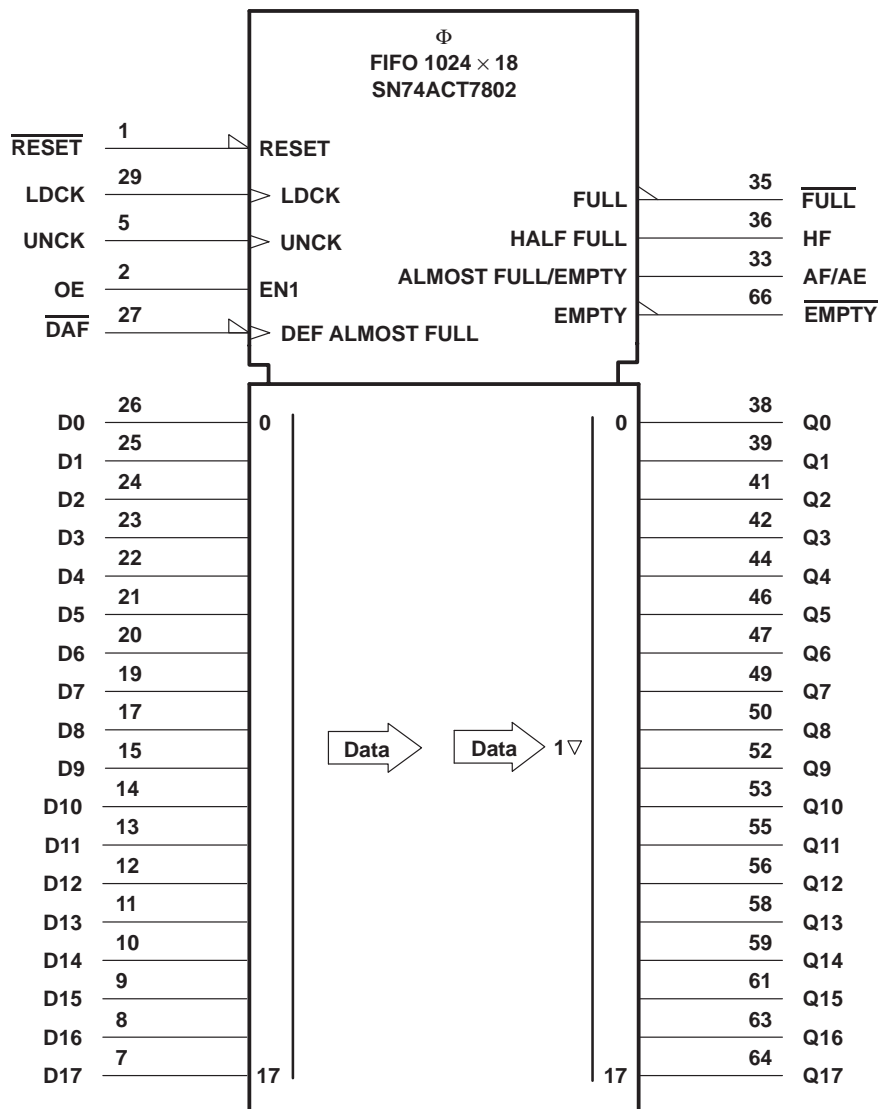
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SN74ACT7802

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logic symbol†

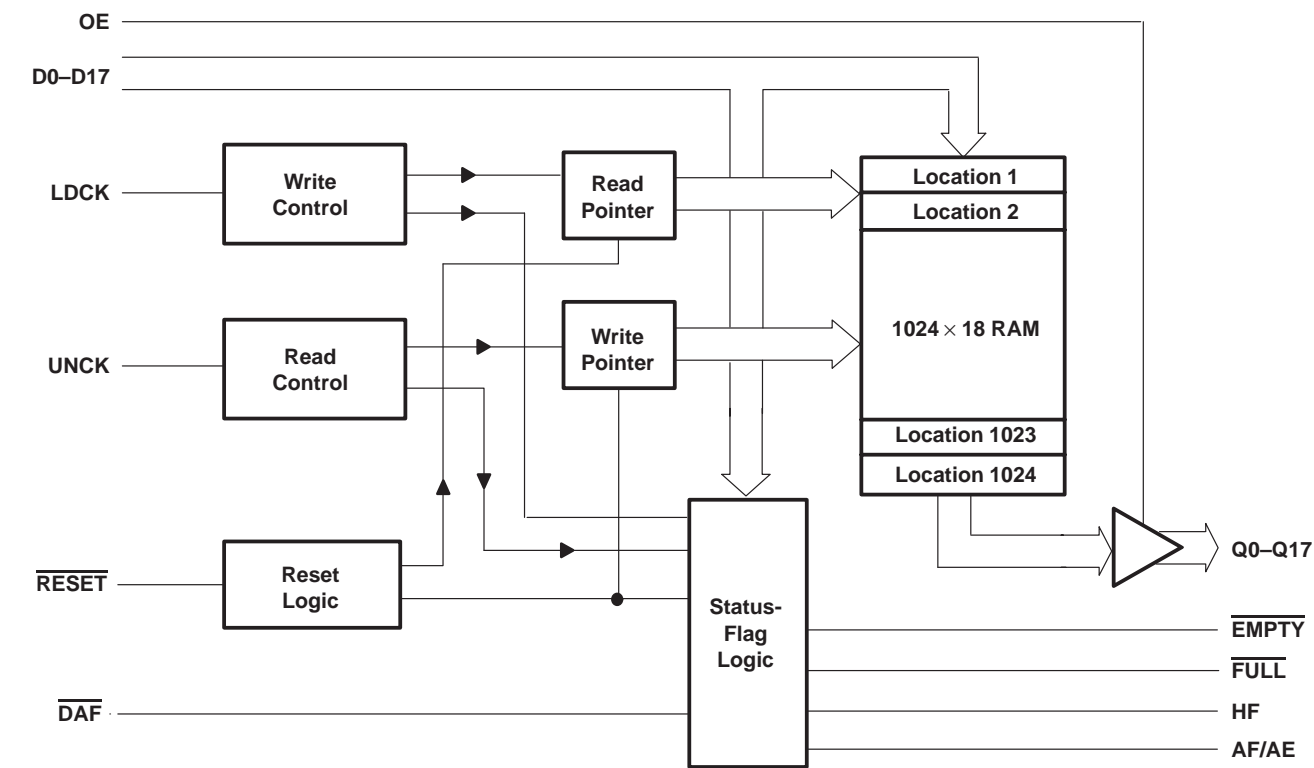


† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the FN package.

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functional block diagram



Terminal Functions

| TERMINAL NAME | NO.† | I/O | DESCRIPTION |
|------------------|--|-----|--|
| AF/AE | 33 | O | Almost-full/almost-empty flag. Depth-offset values can be programmed for AF/AE, or the default value of 256 can be used for the almost-empty almost-full offset (X). AF/AE is high when memory contains X or fewer words or (1024 – X) or more words. AF/AE is high after reset. |
| DAF | 27 | I | Define almost-full flag. The high-to-low transition of DAF stores the binary value of data inputs as the AF/AE offset value (X). With DAF held low, a low pulse on RESET defines AF/AE using X. |
| D0–D17 | 7–15, 17, 19–26 | I | 18-bit data input port |
| EMPTY | 66 | O | Empty flag. EMPTY is low when the FIFO is empty. A FIFO reset also causes EMPTY to go low. |
| FULL | 35 | O | Full flag. FULL is low when the FIFO is full. A FIFO reset causes FULL to go high. |
| HF | 36 | O | Half-full flag. HF is high when the FIFO memory contains 512 or more words. HF is low after reset. |
| LDCK | 29 | I | Load clock. Data is written to the FIFO on the rising edge of LDCK when FULL is high. |
| OE | 2 | I | Output enable. When OE is low, the data outputs are in the high-impedance state. |
| Q0–Q17 | 38–39, 41–42, 44, 46–47, 49–50, 52–53, 55–56, 58–59, 61, 63–64 | O | 18-bit data-output port |
| RESET | 1 | I | Reset. A low level on RESET resets the FIFO and drives AF/AE and FULL high and HF and EMPTY low. |
| UNCK | 5 | I | Unload clock. Data is read from the FIFO on the rising edge of UNCK when EMPTY is high. |

† Terminal numbers listed are for the FN package.



offset value values for AF/AE

The FIFO memory status is monitored by the $\overline{\text{FULL}}$, $\overline{\text{EMPTY}}$, HF, and AF/AE flags. The $\overline{\text{FULL}}$ output is low when the memory is full; the $\overline{\text{EMPTY}}$ output is low when the memory is empty. The HF output is high when the memory contains 512 or more words and low when it contains fewer than 512 words. The level of the AF/AE flag is determined by both the number of words in the FIFO and a user-definable offset X. AF/AE is high when the FIFO is almost full or almost empty, i.e., when it contains X or fewer words or $(1024 - X)$ or more words. The AF/AE offset value is either user-defined or the default value of 256; it is programmed during each reset cycle as follows:

user-defined X:

Take $\overline{\text{DAF}}$ from high to low.

If $\overline{\text{RESET}}$ is not already low, take $\overline{\text{RESET}}$ low.

With $\overline{\text{DAF}}$ held low, take $\overline{\text{RESET}}$ high. This defines the AF/AE flag using X.

default X:

To redefine the AF/AE flag using the default value of $X = 256$, hold $\overline{\text{DAF}}$ high during the reset cycle.

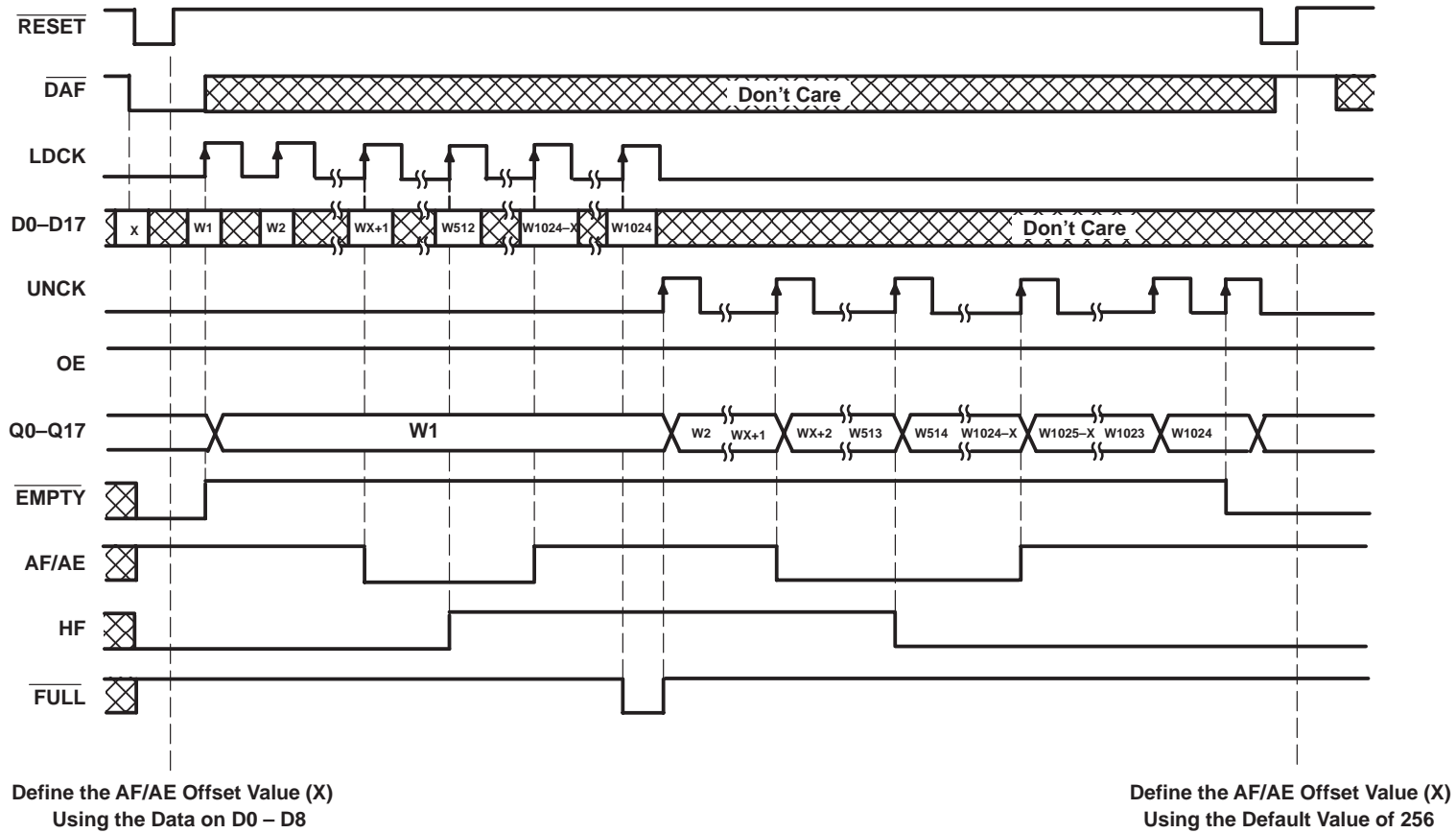


Figure 1. Write, Read, and Flag Timing Reference

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

| | |
|---|-----------------|
| Supply voltage range, V_{CC} | –0.5 V to 7 V |
| Input voltage range, V_I | –0.5 V to 7 V |
| Voltage range applied to a disabled 3-state output | –0.5 V to 5.5 V |
| Package thermal impedance, θ_{JA} (see Note 1): FN package | 39°C/W |
| PN package | 62°C/W |
| Storage temperature range, T_{stg} | –65°C to 150°C |

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions

| | | 'ACT7802-25 | | 'ACT7802-40 | | 'ACT7802-60 | | UNIT |
|----------|--------------------------------|-------------|-----|-------------|-----|-------------|-----|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| V_{CC} | Supply voltage | 4.5 | 5.5 | 4.5 | 5.5 | 4.5 | 5.5 | V |
| V_{IH} | High-level input voltage | 2 | | 2 | | 2 | | V |
| V_{IL} | Low-level input voltage | | 0.8 | | 0.8 | | 0.8 | V |
| I_{OH} | High-level output current | | –8 | | –8 | | –8 | mA |
| I_{OL} | Low-level output current | | 16 | | 16 | | 16 | mA |
| T_A | Operating free-air temperature | 0 | 70 | 0 | 70 | 0 | 70 | °C |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | | MIN | TYP [‡] | MAX | UNIT |
|----------------------|-----------------------------|---|-----|------------------|-----|------|
| V_{OH} | $V_{CC} = 4.5$ V, | $I_{OH} = -8$ mA | 2.4 | | | V |
| V_{OL} | $V_{CC} = 4.5$ V, | $I_{OL} = 16$ mA | | | 0.5 | V |
| I_I | $V_{CC} = 5.5$ V, | $V_I = V_{CC}$ or 0 | | | ±5 | μA |
| I_{OZ} | $V_{CC} = 5.5$ V, | $V_O = V_{CC}$ or 0 | | | ±5 | μA |
| I_{CC}^{\S} | $V_I = V_{CC} - 0.2$ V or 0 | | | | 400 | μA |
| ΔI_{CC}^{\S} | $V_{CC} = 5.5$ V, | One input at 3.4 V, Other inputs at V_{CC} or GND | | | 1 | mA |
| C_i | $V_I = 0$, | $f = 1$ MHz | | 4 | | pF |
| C_o | $V_O = 0$, | $f = 1$ MHz | | 8 | | pF |

[‡] All typical values are at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$.

^{\S} I_{CC} tested with outputs open



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timing requirements over recommended operating conditions (see Figures 1 and 2)

| | | 'ACT7802-25 | | 'ACT7802-40 | | 'ACT7802-60 | | UNIT |
|--------------------|-----------------|--|-----|-------------|-----|-------------|-----|------|
| | | MIN | MAX | MIN | MAX | MIN | MAX | |
| f _{clock} | Clock frequency | 40 | | 25 | | 16.7 | | MHz |
| t _w | Pulse duration | LDCK high or low | | 10 | | 14 | | ns |
| | | UNCK high or low | | 10 | | 14 | | |
| | | DAF high | | 10 | | 10 | | |
| | | RESET low | | 20 | | 25 | | |
| t _{su} | Setup time | D0–D7 before LDCK↑ | | 4 | | 5 | | ns |
| | | RESET inactive (high) before LDCK↑ | | 5 | | 5 | | |
| | | Define AF/AE: D0–D8 before DAF↓ | | 5 | | 5 | | |
| | | Define AF/AE: DAF↓ before RESET↑ | | 7 | | 7 | | |
| | | Define AF/AE (default): DAF high before RESET↑ | | 5 | | 5 | | |
| t _h | Hold time | D0–D7 after LDCK↑ | | 1 | | 2 | | ns |
| | | Define AF/AE: D0–D8 after DAF↓ | | 0 | | 0 | | |
| | | Define AF/AE: DAF low after RESET↑ | | 0 | | 0 | | |
| | | Define AF/AE (default): DAF high after RESET↑ | | 0 | | 0 | | |

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (see Figures 1 and 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | 'ACT7802-25 | | | 'ACT7802-40 | | 'ACT7802-60 | | UNIT |
|----------------------------|--|---------------------------|-------------|---------------|-----|-------------|-----|-------------|-----|------|
| | | | MIN | TYP \dagger | MAX | MIN | MAX | MIN | MAX | |
| f_{max} | LDCK or UNCK | | 40 | | | 25 | | 16.7 | | MHz |
| t_{pd} | LDCK \uparrow | Any Q | 8 | 20 | 30 | 8 | 35 | 8 | 45 | ns |
| | UNCK \uparrow | | 12 | | 30 | 12 | 35 | 12 | 45 | |
| t_{pd}^{\ddagger} | UNCK \uparrow | Any Q | 21 | | | | | | | ns |
| t_{PLH} | LDCK \uparrow | $\overline{\text{EMPTY}}$ | 4 | | 18 | 4 | 20 | 4 | 22 | ns |
| t_{PHL} | UNCK \uparrow | $\overline{\text{EMPTY}}$ | 2 | | 18 | 2 | 20 | 2 | 22 | ns |
| | $\overline{\text{RESET}}$ \downarrow | | 2 | | 18 | 2 | 20 | 2 | 22 | |
| | LDCK \uparrow | $\overline{\text{FULL}}$ | 4 | | 18 | 4 | 20 | 4 | 22 | |
| t_{PLH} | UNCK \uparrow | $\overline{\text{FULL}}$ | 4 | | 17 | 4 | 19 | 4 | 21 | ns |
| | $\overline{\text{RESET}}$ \downarrow | | 2 | | 17 | 2 | 19 | 2 | 21 | |
| t_{pd} | LDCK \uparrow | AF/AE | 2 | | 20 | 2 | 22 | 2 | 24 | ns |
| | UNCK \uparrow | | 2 | | 20 | 2 | 22 | 2 | 24 | |
| t_{PLH} | $\overline{\text{RESET}}$ \downarrow | AF/AE | 2 | | 17 | 2 | 19 | 2 | 21 | ns |
| | LDCK \uparrow | HF | 2 | | 18 | 2 | 20 | 2 | 22 | |
| t_{PHL} | UNCK \uparrow | HF | 2 | | 18 | 2 | 20 | 2 | 22 | ns |
| | $\overline{\text{RESET}}$ \downarrow | | 2 | | 17 | 2 | 19 | 2 | 21 | |
| t_{en} | OE | Any Q | 2 | | 12 | 2 | 14 | 2 | 16 | ns |
| t_{dis} | OE | Any Q | 2 | | 14 | 2 | 16 | 2 | 18 | ns |

\dagger All typical values are at $V_{\text{CC}} = 5$ V, $T_A = 25^\circ\text{C}$.

\ddagger This parameter is measured with $C_L = 30$ pF (see Figure 3).

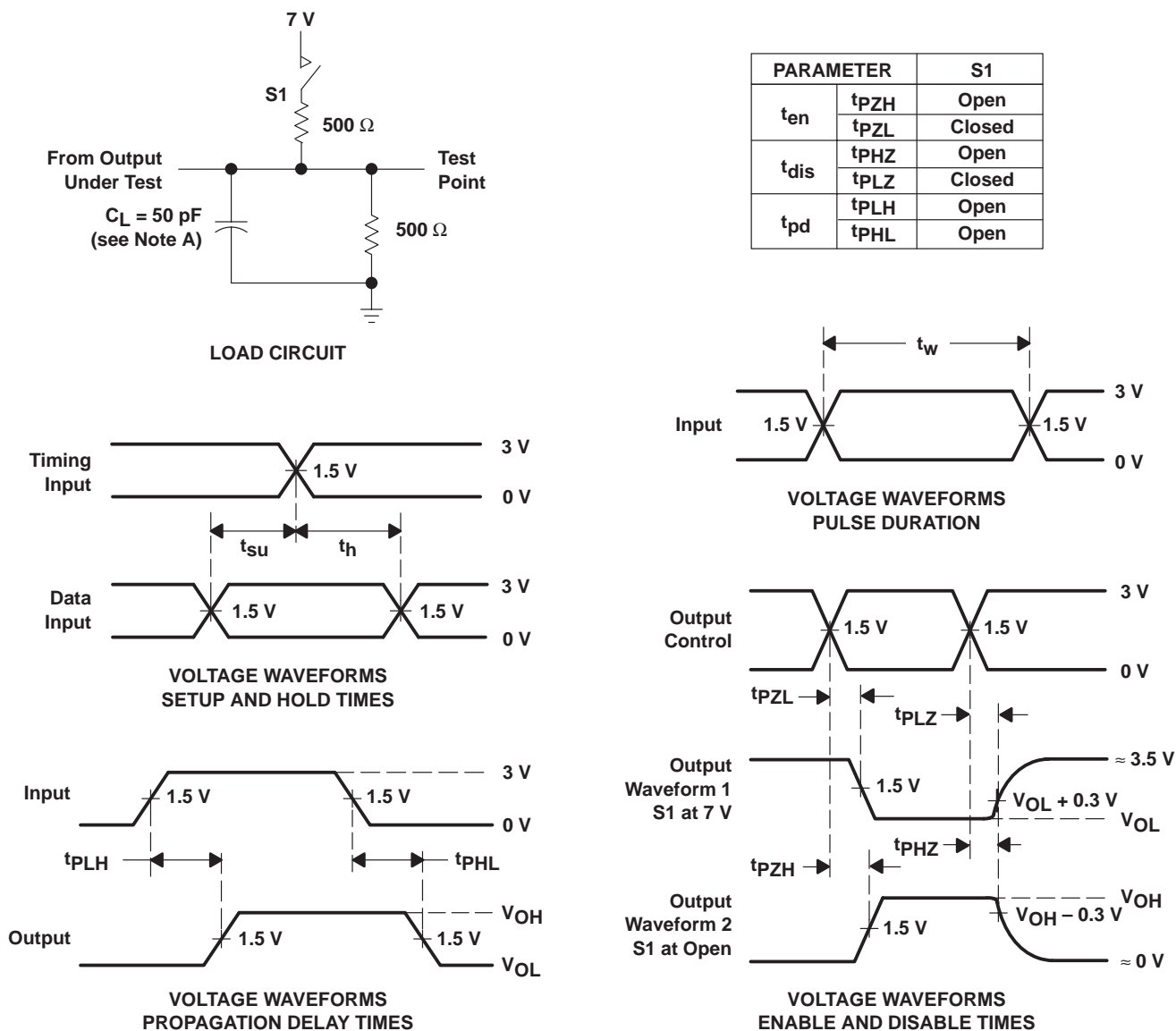
operating characteristics, $V_{\text{CC}} = 5$ V, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|----------------------------|-----|------|
| C_{pd} Power dissipation capacitance per channel | $C_L = 50$ pF, $f = 5$ MHz | 65 | pF |



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PARAMETER MEASUREMENT INFORMATION



NOTE A: C_L includes probe and jig capacitance.

Figure 2. Load Circuit and Voltage Waveforms

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TYPICAL CHARACTERISTICS

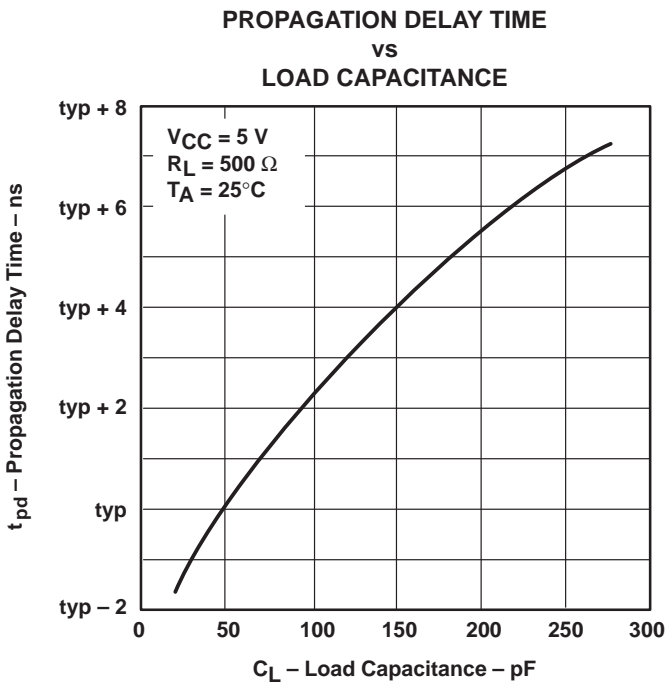


Figure 3

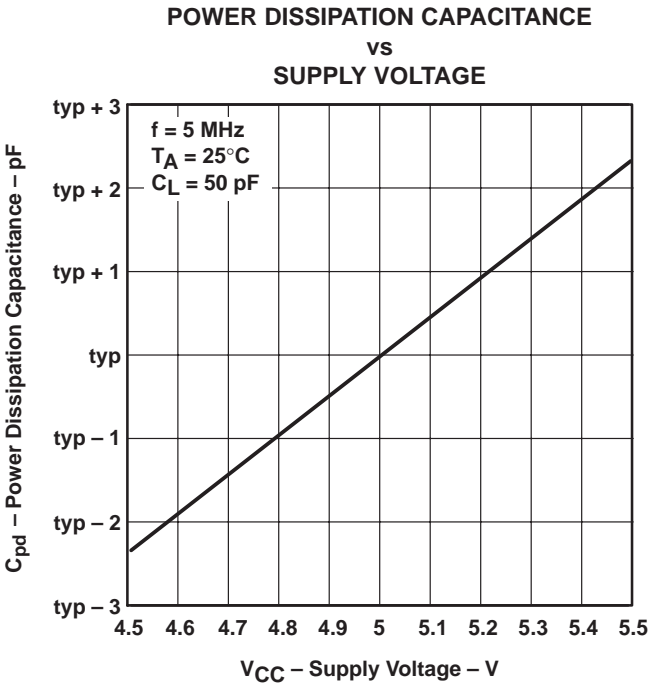


Figure 4

APPLICATION INFORMATION

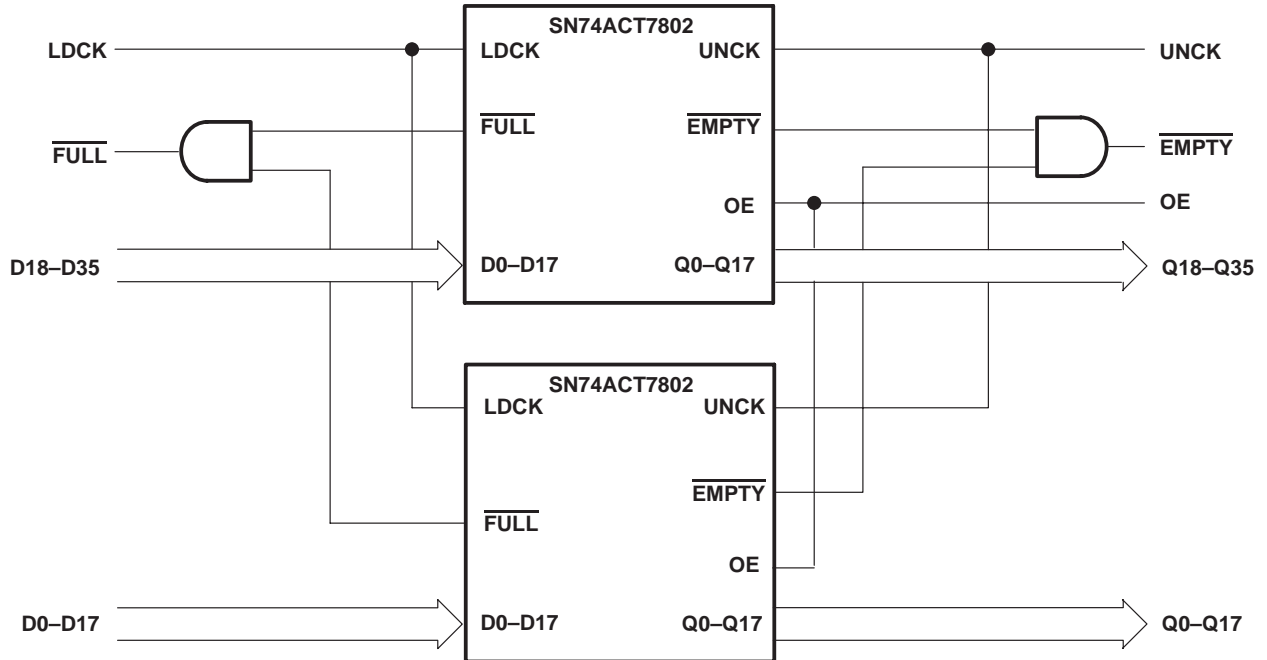


Figure 5. Word-Width Expansion: 1024 × 36 Bit

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 1M7802-60PNG4 | ACTIVE | LQFP | PN | 80 | 119 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |
| SN74ACT7802-25FN | ACTIVE | PLCC | FN | 68 | 18 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |
| SN74ACT7802-25PN | ACTIVE | LQFP | PN | 80 | 119 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |
| SN74ACT7802-40FN | ACTIVE | PLCC | FN | 68 | 18 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |
| SN74ACT7802-40PN | ACTIVE | LQFP | PN | 80 | 119 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |
| SN74ACT7802-60FN | ACTIVE | PLCC | FN | 68 | 18 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |
| SN74ACT7802-60PN | ACTIVE | LQFP | PN | 80 | 119 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-3-260C-168 HR |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

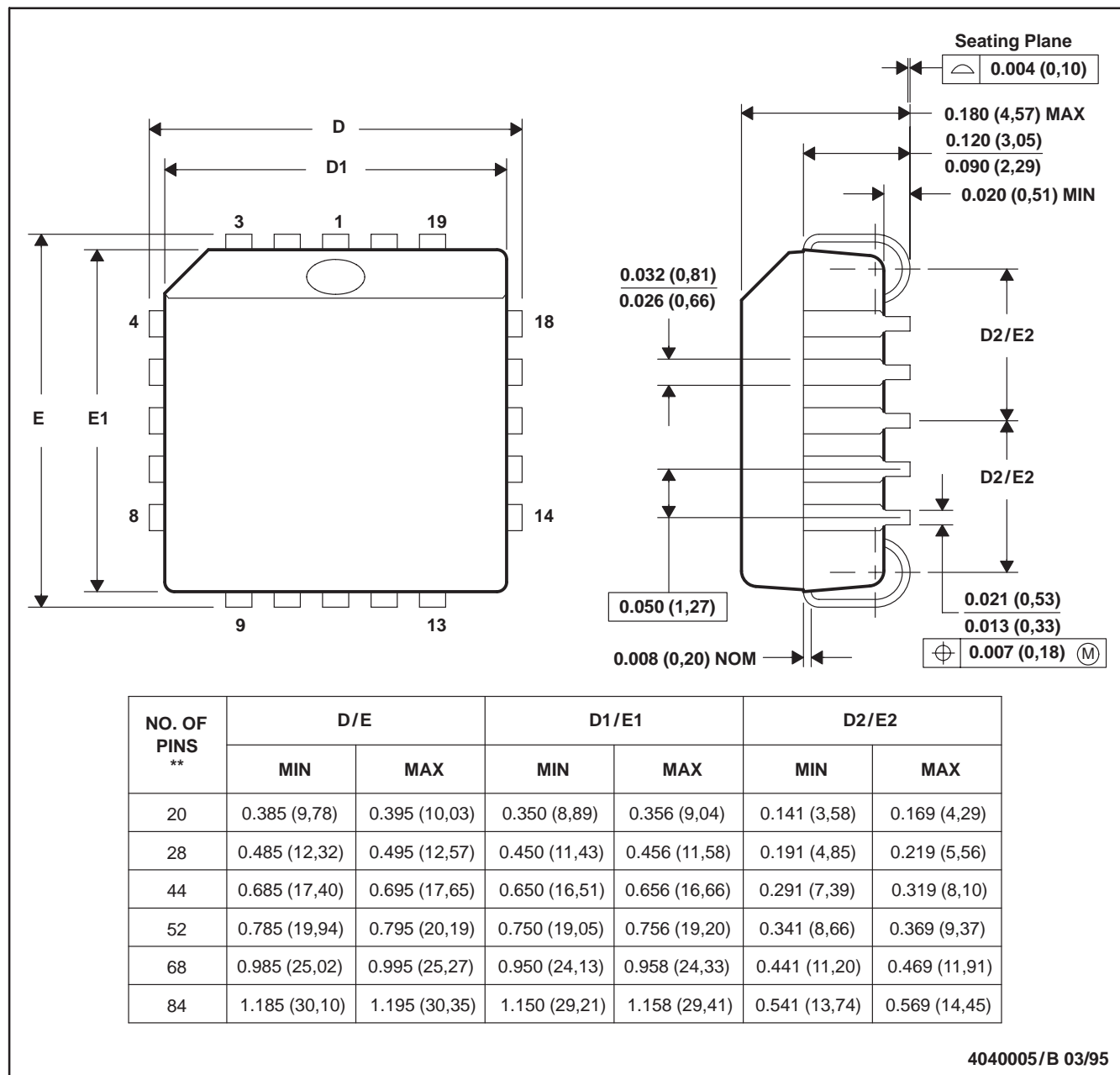
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FN (S-PQCC-J**)

PLASTIC J-LEADED CHIP CARRIER

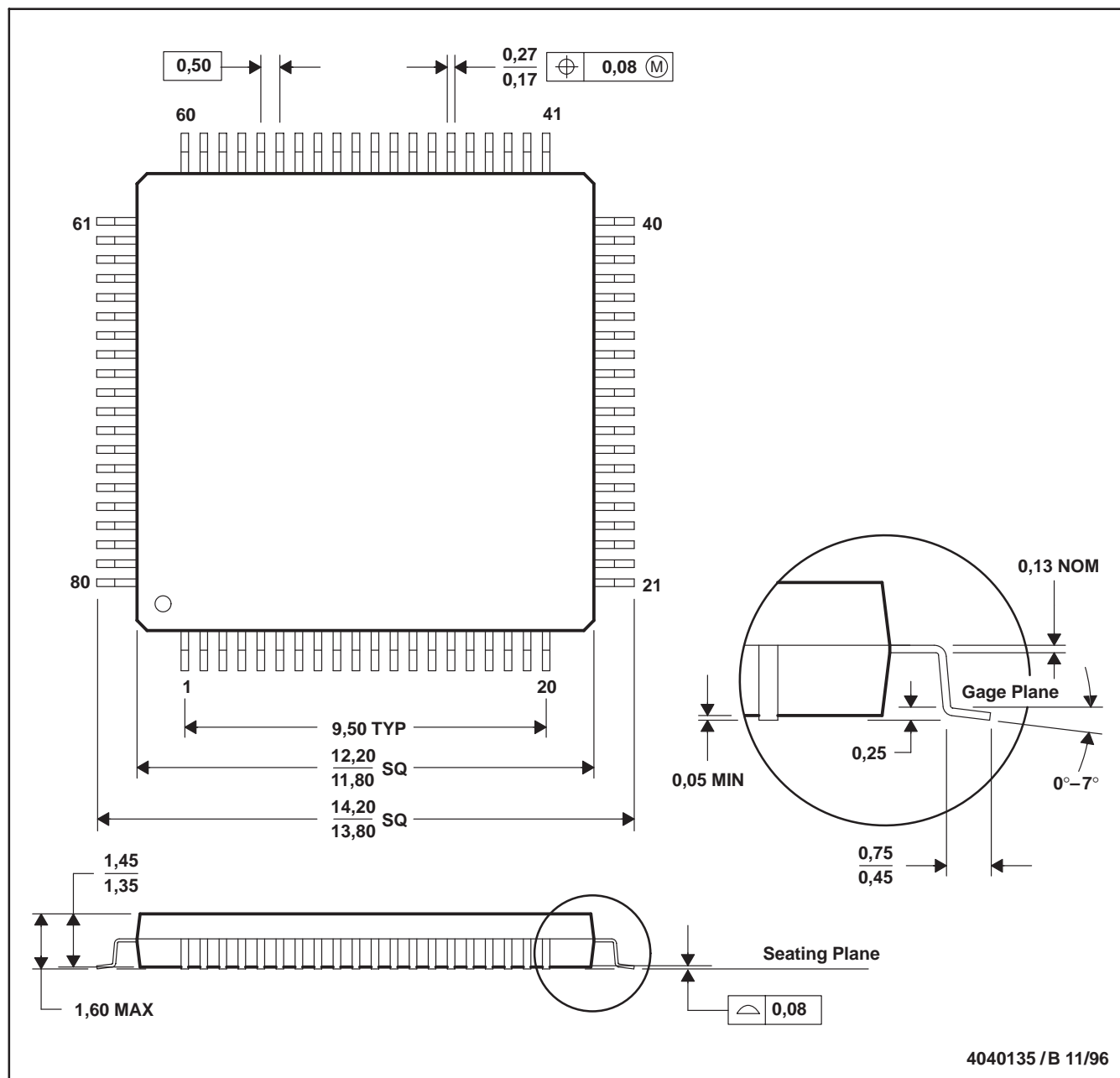
20 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Falls within JEDEC MS-018

PN (S-PQFP-G80)

PLASTIC QUAD FLATPACK



- NOTES: A. All linear dimensions are in millimeters.
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