

SN54166, SN54LS166A, SN74166, SN74LS166A PARALLEL-LOAD 8-BIT SHIFT REGISTERS

OCTOBER 1976 — REVISED MARCH 1988

- Synchronous Load
- Direct Overriding Clear
- Parallel to Serial Conversion

| TYPE | TYPICAL CLOCK FREQUENCY | MAXIMUM CLOCK FREQUENCY | TYPICAL POWER DISSIPATION |
|---------|----------------------------|----------------------------|------------------------------|
| '166 | 35 MHz | | 360 mW |
| 'LS166A | 35 MHz | | 100 mW |

description

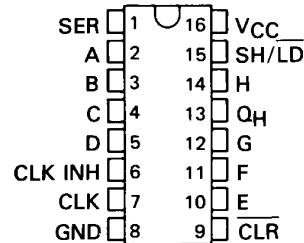
The '166 and 'LS166A 8-bit shift registers are compatible with most other TTL logic families. All '166 and 'LS166A inputs are buffered to lower the drive requirements to one Series 54/74 or Series 54LS/74LS standard load, respectively. Input clamping diodes minimize switching transients and simplify system design.

These parallel-in or serial-in, serial-out shift registers have a complexity of 77 equivalent gates on a monolithic chip. They feature gated clock inputs and an overriding clear input. The parallel-in or serial-in modes are established by the shift/load input. When high, this input enables the serial data input and couples the eight flip-flops for serial shifting with each clock pulse. When low, the parallel (broadside) data inputs are enabled and synchronous loading occurs on the next clock pulse. During parallel loading, serial data flow is inhibited. Clocking is accomplished on the low-to-high-level edge of the clock pulse through a two-input positive NOR gate permitting one input to be used as a clock-enable or clock-inhibit function. Holding either of the clock inputs high inhibits clocking; holding either low enables the other clock input. This, of course, allows the system clock to be free-running and the register can be stopped on command with the other clock input. The clock inhibit input should be changed to the high level only while the clock input is high. A buffered, direct clear input overrides all other inputs, including the clock, and sets all flip-flops to zero.

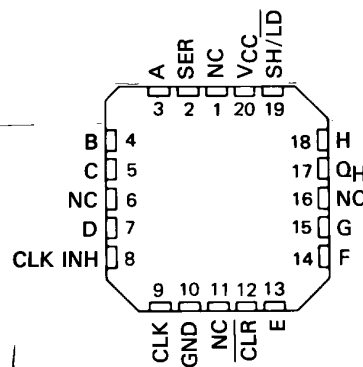
FUNCTION TABLE

| CLEAR | INPUTS | | | | | INTERNAL OUTPUTS Q _A Q _B | OUTPUT Q _H |
|-------|----------------|------------------|-------|--------|-------------------|--|--------------------------|
| | SHIFT/ LOAD | CLOCK INHIBIT | CLOCK | SERIAL | PARALLEL A...H | | |
| L | X | X | X | X | X | L L | L |
| H | X | L | L | X | X | Q _{A0} Q _{B0} | Q _{H0} |
| H | L | L | ↑ | X | a...h | a b | h |
| H | H | L | ↑ | H | X | H Q _{An} | Q _{Gn} |
| H | H | L | ↑ | L | X | L Q _{An} | Q _{Gn} |
| H | X | H | ↑ | X | X | Q _{A0} Q _{B0} | Q _{H0} |

SN54166, SN54LS166A ... J OR W PACKAGE
SN74166 ... N PACKAGE
SN74LS166A ... D OR N PACKAGE
(TOP VIEW)

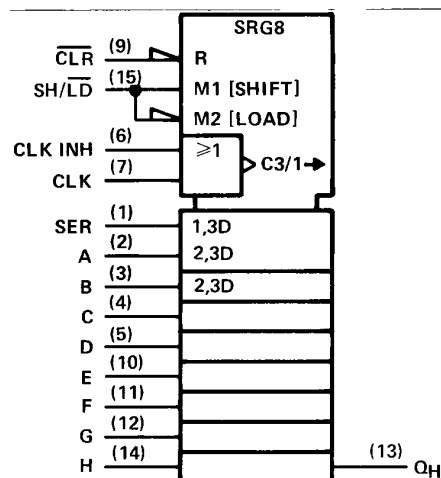


SN54LS166A ... FK PACKAGE
(TOP VIEW)



NC - No internal connection

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

Pin numbers shown are for D, J, N, and W packages.

PRODUCTION DATA documents contain information 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.

TEXAS
INSTRUMENTS

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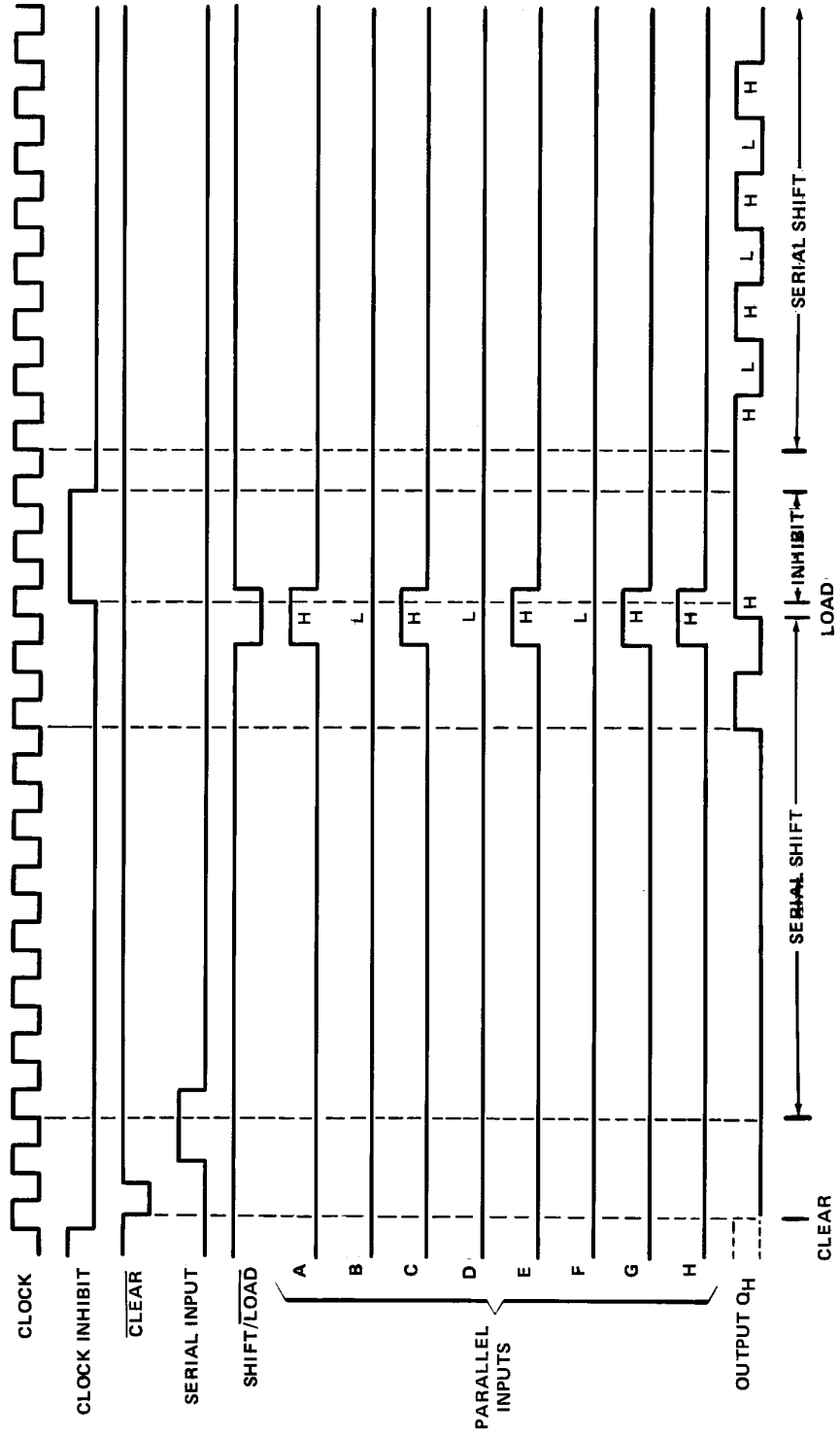
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TTL Devices

**SN54166, SN54LS166A, SN74166, SN74LS166A
PARALLEL-LOAD 8-BIT SHIFT REGISTERS**

typical clear, shift, load, inhibit, and shift sequences



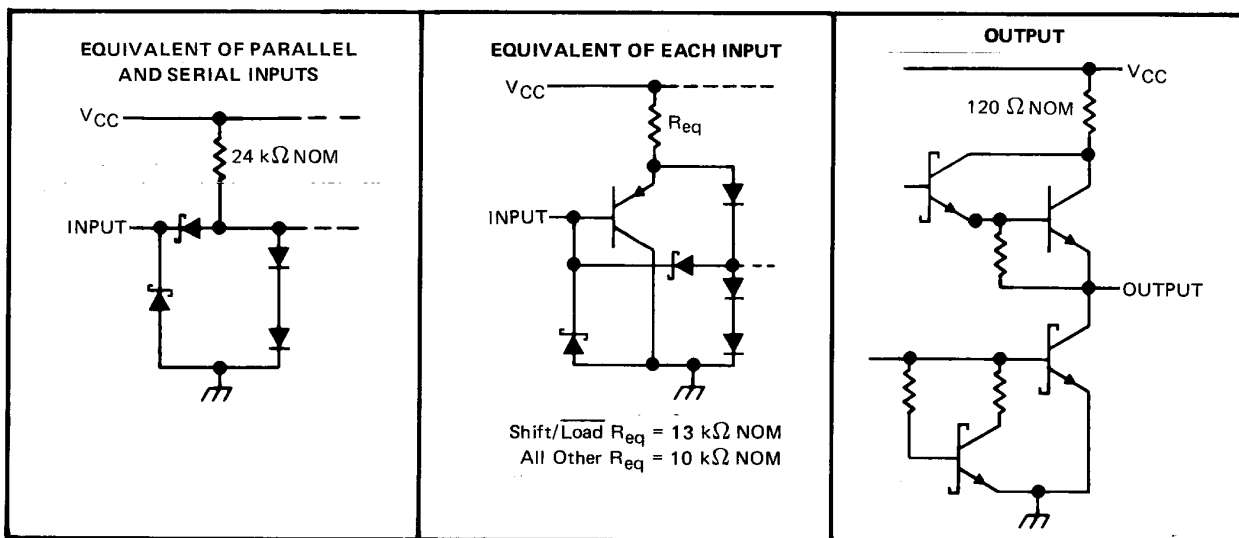
SN54166, SN54LS166A, SN74166, SN74LS166A
PARALLEL-LOAD 8-BIT SHIFT REGISTERS

schematics of inputs and outputs

'166



'LS166A

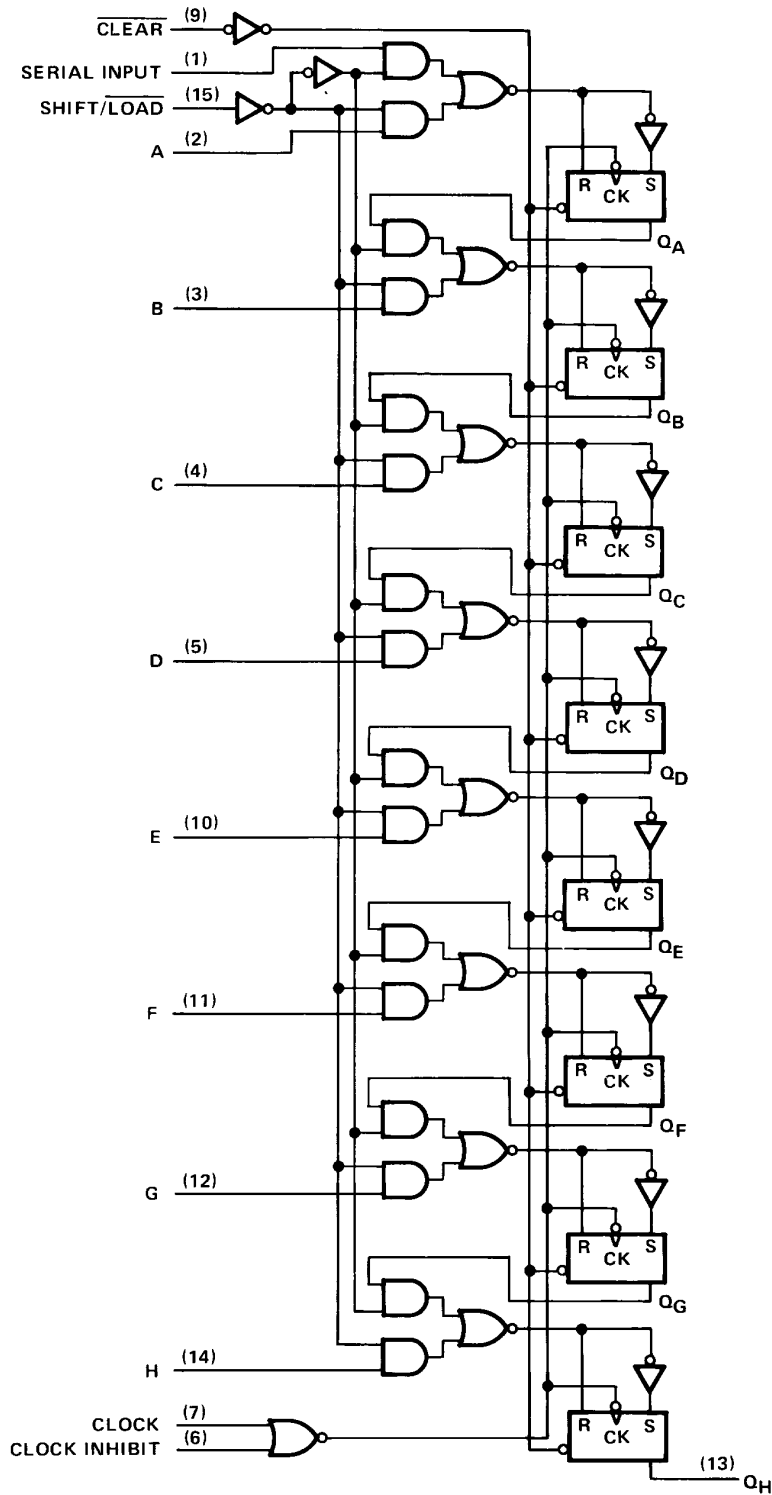


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TTL Devices

SN54166, SN54LS166A, SN74166, SN74LS166A
PARALLEL-LOAD 8-BIT SHIFT REGISTERS

logic diagram (positive logic)



Pin numbers shown are for D, J, N, and W packages.

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TTL Devices

SN54166, SN74166 PARALLEL-LOAD 8-BIT SHIFT REGISTERS

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

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 5.5 V |
| Operating free-air temperature range: SN54166 (see Note 2) | -55°C to 125°C |
| SN74166 | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

recommended operating conditions

| | SN54166 | | | SN74166 | | | UNIT |
|---|---------|-----|------|---------|-----|------|---------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| Supply voltage, V_{CC} | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| High-level output current, I_{OH} | | | -800 | | | -800 | μ A |
| Low-level output current, I_{OL} | | | 16 | | | 16 | mA |
| Clock frequency, f_{clock} | 0 | 25 | | 0 | 25 | | MHz |
| Width of clock or clear pulse, t_W (see Figure 1) | 20 | | | 20 | | | ns |
| Mode-control setup time, t_{SU} | 30 | | | 30 | | | ns |
| Data setup time, t_{SU} (see Figure 1) | 20 | | | 20 | | | ns |
| Hold time at any input, t_H (see Figure 1) | 0 | | | 0 | | | ns |
| Operating free-air temperature, T_A (see Note 2) | -55 | 125 | | 0 | 70 | | °C |

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

| PARAMETER | TEST CONDITIONS [†] | SN54166 | | | SN74166 | | | UNIT |
|--|--|---------|------------------|------|---------|------------------|------|---------|
| | | MIN | TYP [‡] | MAX | MIN | TYP [‡] | MAX | |
| V_{IH} High-level input voltage | | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | | | 0.8 | | | 0.8 | V |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$ | | | -1.5 | | | -1.5 | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = -800 \mu\text{A}$ | 2.4 | 3.4 | | 2.4 | 3.4 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$ | 0.2 | 0.4 | | 0.2 | 0.4 | | V |
| I_I Input current at maximum input voltage | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$ | | | 1 | | | 1 | mA |
| I_{IH} High-level input current | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$ | | | 40 | | | 40 | μ A |
| I_{IL} Low-level input current | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | | | -1.6 | | | -1.6 | mA |
| I_{OS} Short-circuit output current [§] | $V_{CC} = \text{MAX}$ | -20 | -57 | | -18 | -57 | | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX}$, See Note 3 | 90 | 127 | | 90 | 127 | | mA |

[†]For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

[§]Not more than one output should be shorted at a time.

NOTES: 1. Voltage values are with respect to network ground terminal.

2. An SN54166 in the W package operating at free-air temperatures above 113°C requires a heat-sink that provides a thermal resistance from case to free air, $R_{\theta CA}$, of not more than 48°C/W.

3. With all outputs open, 4.5 V applied to the serial input, all other inputs except the clock grounded, I_{CC} is measured after a momentary ground, then 4.5 V, is applied to the clock.

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

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|--|-----|-----|-----|------|
| f_{max} Maximum clock frequency | | 25 | 35 | | MHz |
| t_{PHL} Propagation delay time, high-to-low-level output from clear | | | 23 | 35 | ns |
| t_{PHL} Propagation delay time, high-to-low-level output from clock | $C_L = 15 \text{ pF}, R_L = 400 \Omega,$ See Figure 1 | | 20 | 30 | ns |
| t_{PLH} Propagation delay time, low-to-high-level output from clock | | | 17 | 26 | ns |

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TTL Devices

SN54LS166A, SN74LS166A PARALLEL-LOAD 8-BIT SHIFT REGISTERS

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

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage | 7 V |
| Operating free-air temperature range: SN54LS166A | -55°C to 125°C |
| SN74LS166A | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

| | | SN54LS166A | | | SN74LS166A | | | UNIT |
|-------------|--|------------|-----|------|------------|-----|------|------|
| | | MIN | TYP | MAX | MIN | TYP | MAX | |
| V_{CC} | Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V_{IH} | High-level input voltage | 2 | | | 2 | | | V |
| V_{IL} | Low-level input voltage | | | 0.7 | | | 0.8 | V |
| I_{OH} | High-level output current | | | -0.4 | | | -0.4 | mA |
| I_{OL} | Low-level output current | | | 4 | | | 8 | mA |
| f_{clock} | Clock frequency | 0 | | 25 | 0 | | 25 | MHz |
| t_w | Width of clear pulse (See Figure 1) | 20 | | | 20 | | | ns |
| t_w | Width of clock pulse (See Figure 1) | 25 | | | 25 | | | |
| t_{su} | Mode-control setup time | 30 | | | 30 | | | ns |
| t_{su} | Data setup time (See Figure 1) | 20 | | | 20 | | | ns |
| t_h | Hold time at any input (See Figure 1 and Note 4) | 0 | | | 0 | | | ns |
| T_A | Operating free air temperature | -55 | | 125 | 0 | | 70 | °C |

NOTE 4: The hold time limit of 0 ns applies only if the rise time is less than or equal to 10 ns.

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

| PARAMETER | TEST CONDITIONS † | SN54LS166A | | | SN74LS166A | | | UNIT | |
|------------|--|------------|-------|------|------------|-------|------|------|---|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | | |
| V_{IK} | $V_{CC} = \text{MIN}$, $I_I = -18 \text{ mA}$ | | | -1.5 | | | -1.5 | V | |
| V_{OH} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$, $I_{OH} = -0.4 \text{ mA}$ | 2.5 | 3.4 | | 2.7 | 3.4 | | V | |
| V_{OL} | $V_{CC} = \text{MIN}$, $V_{IH} = 2 \text{ V}$, $V_{IL} = \text{MAX}$ | | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | | | | | | | 0.35 | 0.5 | |
| I_I | $V_{CC} = \text{MAX}$, $V_I = 7 \text{ V}$ | | | 0.1 | | | 0.1 | mA | |
| I_{IH} | $V_{CC} = \text{MAX}$, $V_I = 2.7 \text{ V}$ | | | 20 | | | 20 | µA | |
| I_{IL} | $V_{CC} = \text{MAX}$, $V_I = 0.4 \text{ V}$ | | | -0.4 | | | -0.4 | mA | |
| $I_{OS} §$ | $V_{CC} = \text{MAX}$ | -20 | | -100 | -20 | | -100 | mA | |
| I_{CC} | $V_{CC} = \text{MAX}$, See Note 5 | | 20 | 32 | | 20 | 32 | mA | |

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

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

§Not more than one output should be shorted at a time, and duration for short-circuit should not exceed one second.

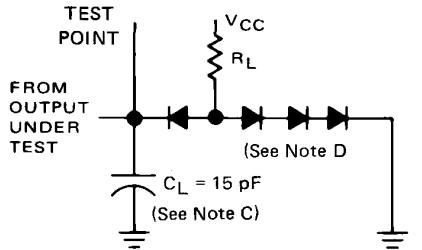
NOTE 5: With all outputs open, 4.5 V applied to the serial input and all other inputs except the clock grounded, I_{CC} is measured after a momentary ground, than 4.5 V, is applied to clock.

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

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|-----|-----|-----|------|
| f_{max} Maximum clock frequency | | 25 | 35 | | MHz |
| t_{PHL} Propagation delay time, high-to-low-level output from clear | $C_L = 15 \text{ pF}$, $R_L = 2 \text{ k}\Omega$, See Figure 1 | | 19 | 30 | ns |
| t_{PHL} Propagation delay time, high-to-low-level output from clock | | 7 | 14 | 25 | ns |
| t_{PLH} Propagation delay time, low-to-high-level output from clock | | 5 | 11 | 20 | ns |

SN54166, SN54LS166A, SN74166, SN74LS166A PARALLEL-LOAD 8-BIT SHIFT REGISTERS

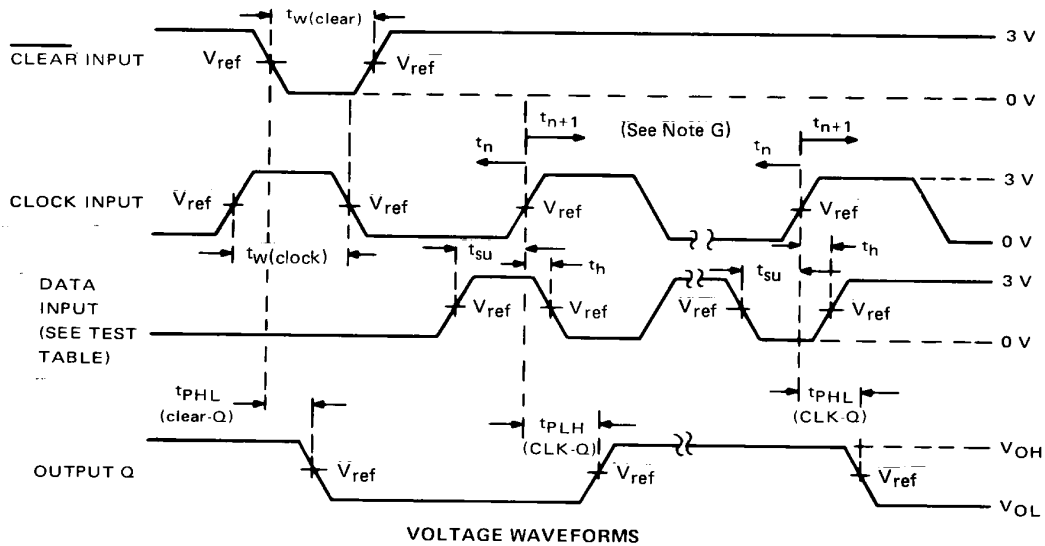
PARAMETER MEASUREMENT INFORMATION



LOAD FOR OUTPUT UNDER TEST

TEST TABLE FOR SYNCHRONOUS INPUTS

| DATA INPUT FOR TEST | SHIFT/LOAD | OUTPUT TESTED (SEE NOTE F) |
|---------------------|------------|----------------------------|
| H | 0 V | Q_H at t_{n+1} |
| Serial Input | 4.5 V | Q_H at t_{n+8} |



VOLTAGE WAVEFORMS

- NOTE: A. All pulse generators have the following characteristics: $Z_{out} \approx 50\Omega$; for '166, $t_r \leq 7$ ns and $t_f \leq 7$ ns; for 'LS166A, $t_r \leq 15$ ns and $t_f \leq 6$ ns.
- B. The clock pulse has the following characteristics: $t_w(\text{clock}) \leq 20$ ns and $\text{PRR} = 1$ MHz. The clear pulse has the following characteristics: $t_w(\text{clear}) \leq 20$ ns and $t_{\text{hold}} = 0$ ns. When testing f_{max} , vary the clock PRR.
- C. C_L includes probe and jig capacitance.
- D. All diodes are 1N3064, 1N916, or equivalent.
- E. A clear pulse is applied prior to each test.
- F. Propagation delay times (t_{PLH} and t_{PHL}) are measured at t_{n+1} . Proper shifting of data is verified at t_{n+8} with a functional test.
- G. t_n = bit time before clocking transition
 t_{n+1} = bit time after one clocking transition
 t_{n+8} = bit time after eight clocking transitions
- H. For '166 $V_{\text{ref}} = 1.5$ V; for 'LS166A $V_{\text{ref}} = 1.3$ V.

FIGURE 1

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|---------------------|--------------------------------------|----------------------|--------------|----------------------------------|-------------------------|
| 5962-9558301QEA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QE A SNJ54166J | Samples |
| 5962-9558301QFA | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QF A SNJ54166W | Samples |
| 5962-9558301QFA | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QF A SNJ54166W | Samples |
| 8001701EA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701EA SNJ54LS166AJ | Samples |
| 8001701EA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701EA SNJ54LS166AJ | Samples |
| 8001701FA | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701FA SNJ54LS166AW | Samples |
| 8001701FA | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701FA SNJ54LS166AW | Samples |
| JM38510/30609B2A | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609B2A | Samples |
| JM38510/30609B2A | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609B2A | Samples |
| JM38510/30609BEA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609BEA | Samples |
| JM38510/30609BEA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609BEA | Samples |
| M38510/30609B2A | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609B2A | Samples |
| M38510/30609B2A | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609B2A | Samples |
| M38510/30609BEA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609BEA | Samples |
| M38510/30609BEA | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 30609BEA | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|----------------------------------|-------------------------|
| SN54166J | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54166J | Samples |
| SN54166J | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54166J | Samples |
| SN54LS166AJ | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54LS166AJ | Samples |
| SN54LS166AJ | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54LS166AJ | Samples |
| SN74LS166ADR | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS166A | Samples |
| SN74LS166ADR | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS166A | Samples |
| SN74LS166AN | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS166AN | Samples |
| SN74LS166AN | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS166AN | Samples |
| SN74LS166ANSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS166A | Samples |
| SN74LS166ANSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS166A | Samples |
| SNJ54166J | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QE A SNJ54166J | Samples |
| SNJ54166J | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QE A SNJ54166J | Samples |
| SNJ54166W | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QF A SNJ54166W | Samples |
| SNJ54166W | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 5962-9558301QF A SNJ54166W | Samples |
| SNJ54LS166AFK | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS 166AFK | Samples |
| SNJ54LS166AFK | ACTIVE | LCCC | FK | 20 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS 166AFK | Samples |
| SNJ54LS166AJ | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701EA SNJ54LS166AJ | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead finish/ Ball material (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|---------------------------|-------------------------|
| SNJ54LS166AJ | ACTIVE | CDIP | J | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701EA SNJ54LS166AJ | Samples |
| SNJ54LS166AW | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701FA SNJ54LS166AW | Samples |
| SNJ54LS166AW | ACTIVE | CFP | W | 16 | 1 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 8001701FA SNJ54LS166AW | Samples |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF SN54LS166A, SN74LS166A :

- Catalog : [SN74LS166A](#)
- Military : [SN54LS166A](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS166ADR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74LS166ANSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS166ADR | SOIC | D | 16 | 2500 | 340.5 | 336.1 | 32.0 |
| SN74LS166ANSR | SO | NS | 16 | 2000 | 356.0 | 356.0 | 35.0 |

TUBE


*All dimensions are nominal

| Device | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-9558301QFA | W | CFP | 16 | 1 | 506.98 | 26.16 | 6220 | NA |
| 8001701FA | W | CFP | 16 | 1 | 506.98 | 26.16 | 6220 | NA |
| JM38510/30609B2A | FK | LCCC | 20 | 1 | 506.98 | 12.06 | 2030 | NA |
| M38510/30609B2A | FK | LCCC | 20 | 1 | 506.98 | 12.06 | 2030 | NA |
| SN74LS166AN | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS166AN | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SNJ54166W | W | CFP | 16 | 1 | 506.98 | 26.16 | 6220 | NA |
| SNJ54LS166AFK | FK | LCCC | 20 | 1 | 506.98 | 12.06 | 2030 | NA |
| SNJ54LS166AW | W | CFP | 16 | 1 | 506.98 | 26.16 | 6220 | NA |



PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER MASK DETAILS

4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

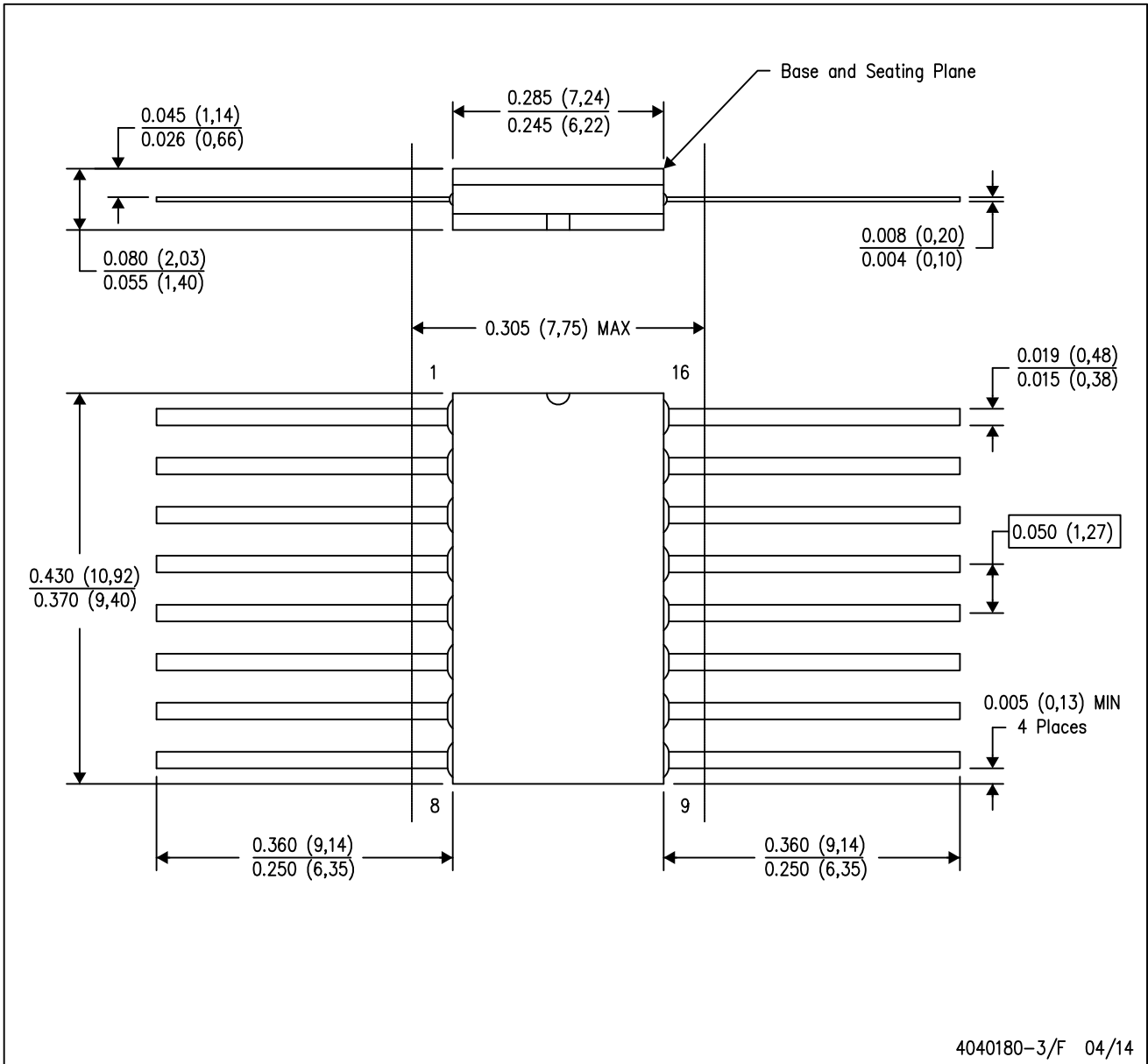
4220735/A 12/2021

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only.
 - E. Falls within MIL STD 1835 GDFP2-F16

GENERIC PACKAGE VIEW

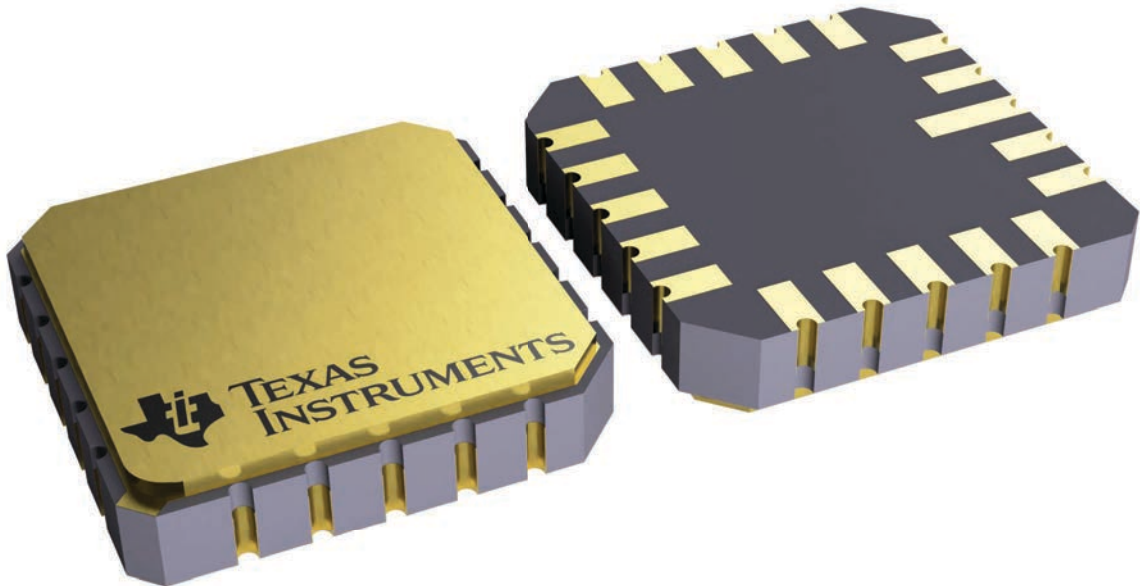
FK 20

LCCC - 2.03 mm max height

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



4229370VA\

J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |



4040083/F 03/03

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package is hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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