



**THE DATASHEET OF
JM38510/32702BCA**



SN54390, SN54LS390, SN54393, SN54LS393 SN74390, SN74LS390, SN74393, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

SDLS107 - OCTOBER 1976 - REVISED MARCH 1988

- Dual Versions of the Popular '90A, 'LS90 and '93A, 'LS93
- '390, 'LS390 . . . Individual Clocks for A and B Flip-Flops Provide Dual $\div 2$ and $\div 5$ Counters
- '393, 'LS393 . . . Dual 4-Bit Binary Counter with Individual Clocks
- All Have Direct Clear for Each 4-Bit Counter
- Dual 4-Bit Versions Can Significantly Improve System Densities by Reducing Counter Package Count by 50%
- Typical Maximum Count Frequency . . . 35 MHz
- Buffered Outputs Reduce Possibility of Collector Commutation

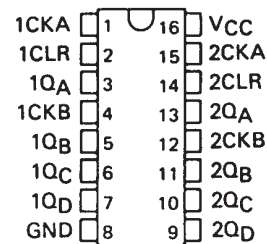
description

Each of these monolithic circuits contains eight master-slave flip-flops and additional gating to implement two individual four-bit counters in a single package. The '390 and 'LS390 incorporate dual divide-by-two and divide-by-five counters, which can be used to implement cycle lengths equal to any whole and/or cumulative multiples of 2 and/or 5 up to divide-by-100. When connected as a bi-quinary counter, the separate divide-by-two circuit can be used to provide symmetry (a square wave) at the final output stage. The '393 and 'LS393 each comprise two independent four-bit binary counters each having a clear and a clock input. N-bit binary counters can be implemented with each package providing the capability of divide-by-256. The '390, 'LS390, '393, and 'LS393 have parallel outputs from each counter stage so that any submultiple of the input count frequency is available for system-timing signals.

Series 54 and Series 54LS circuits are characterized for operation over the full military temperature range of -55°C to 125°C ; Series 74 and Series 74LS circuits are characterized for operation from 0°C to 70°C .

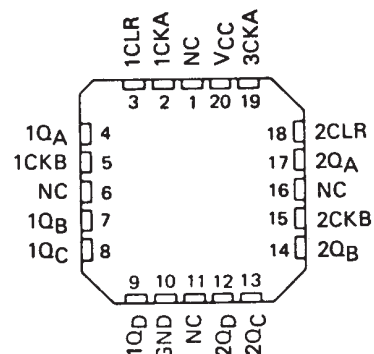
SN54390, SN54LS390 . . . J OR W PACKAGE
SN74390 . . . N PACKAGE
SN74LS390 . . . D OR N PACKAGE

(TOP VIEW)



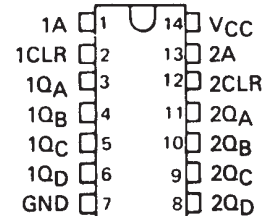
SN54LS390 . . . FK PACKAGE

(TOP VIEW)



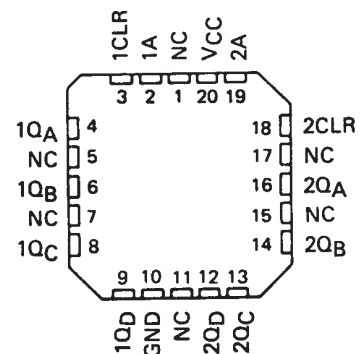
SN54393, SN54LS393 . . . J OR W PACKAGE
SN74393 . . . N PACKAGE
SN74LS393 . . . D OR N PACKAGE

(TOP VIEW)



SN54LS393 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

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.

 **TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 1988, Texas Instruments Incorporated

SN54390, SN54LS390, SN54393, SN54LS393 SN74390, SN74LS390, SN74393, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

SDLS107 - OCTOBER 1976 - REVISED MARCH 1988

**'390, 'LS390
BCD COUNT SEQUENCE
(EACH COUNTER)
(See Note A)**

| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q _D | Q _C | Q _B | Q _A |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | L | H | L | H |
| 6 | L | H | H | L |
| 7 | L | H | H | H |
| 8 | H | L | L | L |
| 9 | H | L | L | H |

**FUNCTION TABLES
'390, 'LS390
BI-QUINARY (5-2)
(EACH COUNTER)
(See Note B)**

| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q _A | Q _D | Q _C | Q _B |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | H | L | L | L |
| 6 | H | L | L | H |
| 7 | H | L | H | L |
| 8 | H | L | H | H |
| 9 | H | H | L | L |

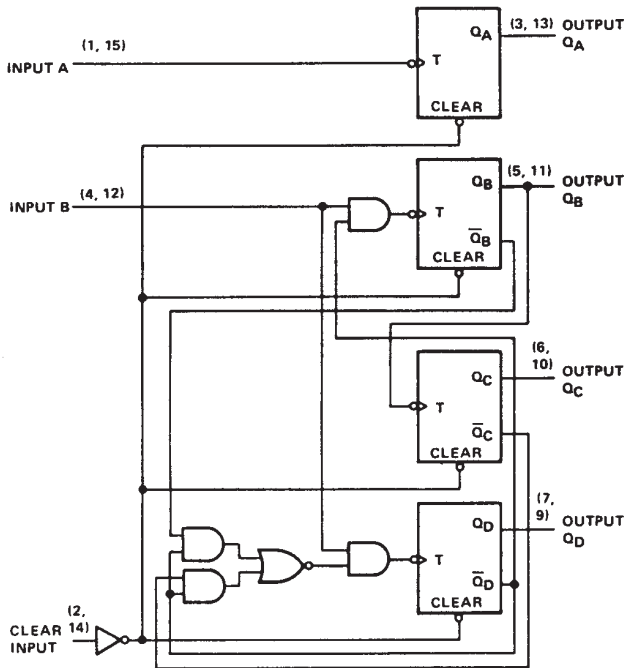
**'393, 'LS393
COUNT SEQUENCE
(EACH COUNTER)**

| COUNT | OUTPUT | | | |
|-------|----------------|----------------|----------------|----------------|
| | Q _D | Q _C | Q _B | Q _A |
| 0 | L | L | L | L |
| 1 | L | L | L | H |
| 2 | L | L | H | L |
| 3 | L | L | H | H |
| 4 | L | H | L | L |
| 5 | L | H | L | H |
| 6 | L | H | H | L |
| 7 | L | H | H | H |
| 8 | H | L | L | L |
| 9 | H | L | L | H |
| 10 | H | L | H | L |
| 11 | H | L | H | H |
| 12 | H | H | L | L |
| 13 | H | H | L | H |
| 14 | H | H | H | L |
| 15 | H | H | H | H |

NOTES: A. Output Q_A is connected to input B for BCD count.
B. Output Q_D is connected to input A for bi-quinary count.
C. H = high level, L = low level.

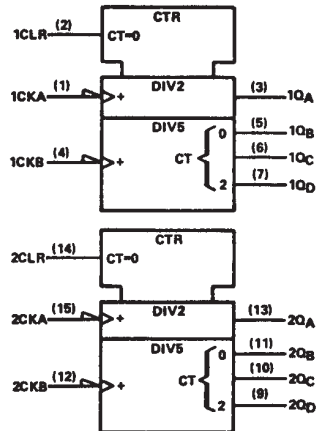
logic diagrams (positive logic)

'390, 'LS390

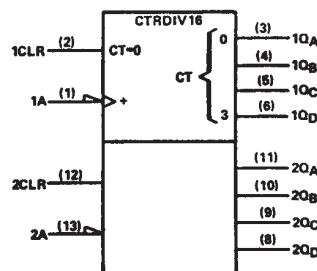


logic symbols †

'390, 'LS390



'393, 'LS393



†These symbols are in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

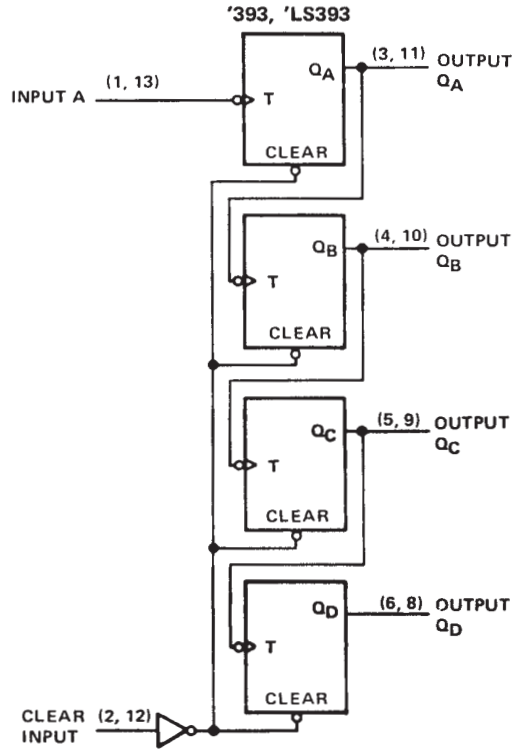
Pin numbers shown are for D, J, N, and W packages.



SN54390, SN54LS390, SN54393, SN54LS393
 SN74390, SN74LS390, SN74393, SN74LS393
 DUAL 4-BIT DECADE AND BINARY COUNTERS

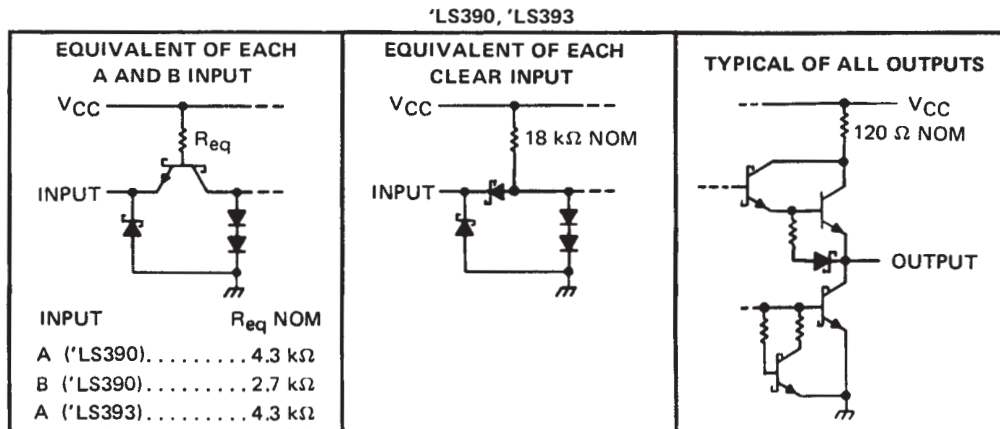
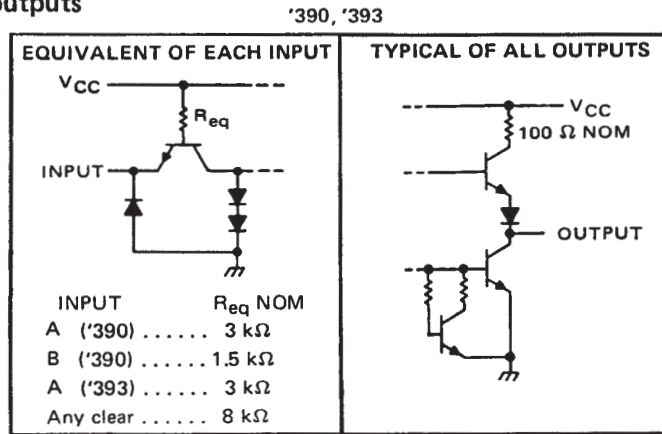
SDLS107 - OCTOBER 1976 - REVISED MARCH 1988

logic diagrams (continued)



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

schematics of inputs and outputs



SN54390, SN54LS390, SN54393, SN54LS393 SN74390, SN74LS390, SN74393, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

SDLS107 – OCTOBER 1976 – REVISED MARCH 1988

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: SN54390, SN54393 | -55°C to 125°C |
| SN74390, SN74393 | 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

| | SN54390 SN54393 | | | SN74390 SN74393 | | | 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 | |
| Count frequency, f_{count} | A input | | 0 | 25 | 0 | | 25 | MHz |
| | B input | | 0 | 20 | 0 | | 20 | |
| Pulse width, t_w | A input high or low | | 20 | | 20 | | ns | |
| | B input high or low | | 25 | | 25 | | | |
| | Clear high | | 20 | | 20 | | | |
| Clear inactive-state setup time, t_{SU} | 25 | | 25 | | 25 | | ns | |
| Operating free-air temperature, T_A | -55 | | 125 | | 0 | | 70 | °C |

↓ The arrow indicates that the falling edge of the clock pulse is used for reference.

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

| PARAMETER | TEST CONDITIONS† | '390 | | | '393 | | | 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 | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA} \uparrow$ | | 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 | Clear | 40 | | | 40 | | | μ A |
| | Input A | 80 | | | 80 | | | |
| | Input B | 120 | | | | | | |
| I_{IL} Low-level input current | Clear | -1 | | | -1 | | | mA |
| | Input A | -3.2 | | | -3.2 | | | |
| | Input B | -4.8 | | | | | | |
| I_{OS} Short-circuit output current § | $V_{CC} = \text{MAX}$ | SN54' | -20 | -57 | -20 | -57 | mA | |
| | | SN74' | -18 | -57 | -18 | -57 | | |
| I_{CC} Supply current | $V_{CC} = \text{MAX}, \text{ See Note 2}$ | 42 | 69 | | 38 | 64 | 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.

¶ The Q_A outputs of the '390 are tested at $I_{OL} = 16 \text{ mA}$ plus the limit value for I_{IL} for the B input. This permits driving the B input while maintaining full fan-out capability.

NOTE 2: I_{CC} is measured with all outputs open, both clear inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.



SN54390, SN54LS390, SN54393, SN54LS393
 SN74390, SN74LS390, SN74393, SN74LS393
 DUAL 4-BIT DECADE AND BINARY COUNTERS

SDLS107 – OCTOBER 1976 – REVISED MARCH 1988

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

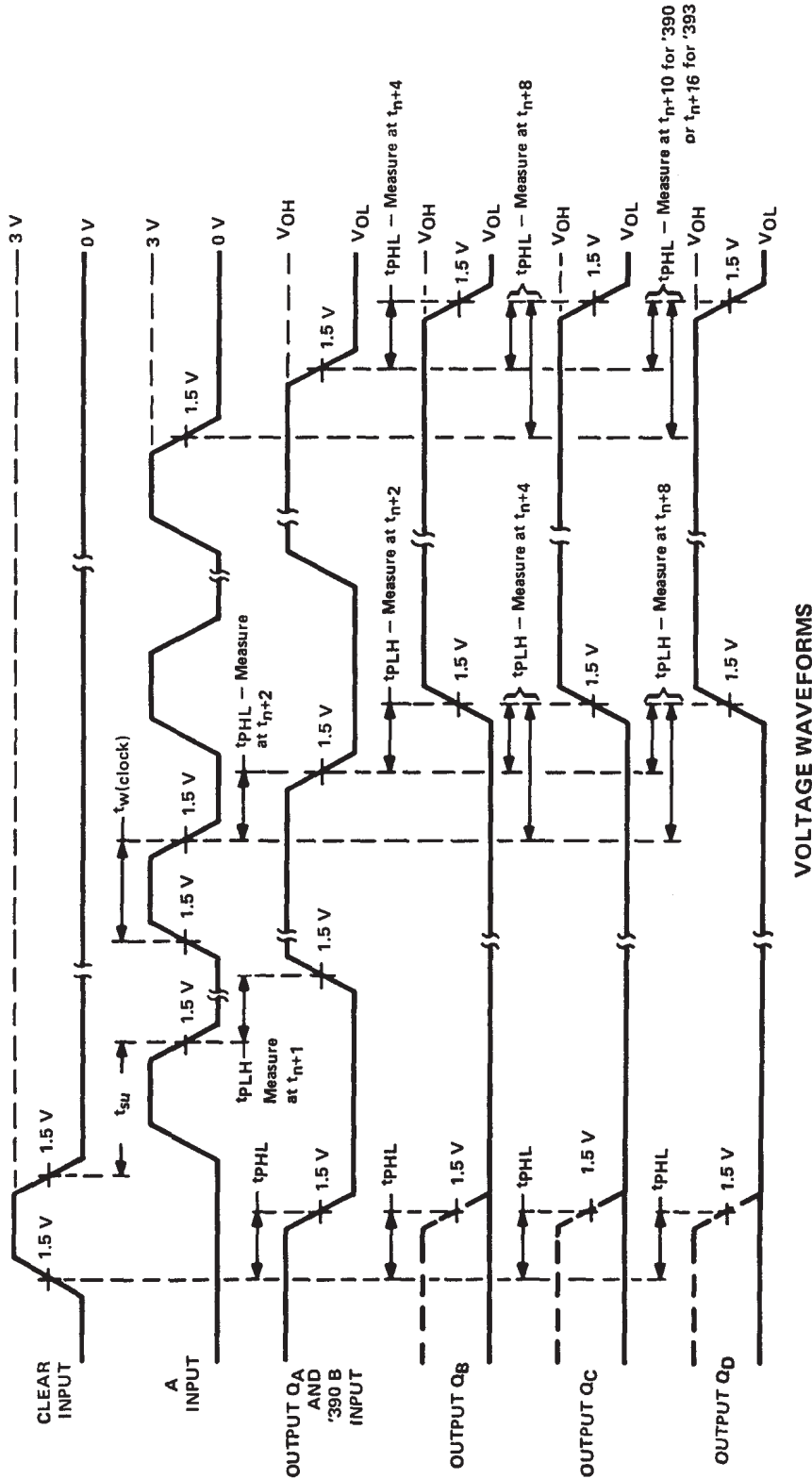
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | '390 | | | '393 | | | UNIT |
|------------|-----------------|--------------------------------|--|------|-----|-----|------|-----|-----|------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| f_{\max} | A | Q_A | $C_L = 15\text{ pF}$, $R_L = 400\ \Omega$, See Note 3 and Figure 1 | 25 | 35 | | 25 | 35 | MHz | |
| | B | Q_B | | 20 | 30 | | | | | |
| t_{PLH} | A | Q_A | | 12 | 20 | | 12 | 20 | ns | |
| t_{PHL} | | | | 13 | 20 | | 13 | 20 | | |
| t_{PLH} | A | Q_C of '390 Q_D of '393 | | 37 | 60 | | 40 | 60 | ns | |
| t_{PHL} | | | | 39 | 60 | | 40 | 60 | | |
| t_{PLH} | B | Q_B | | 13 | 21 | | | | ns | |
| t_{PHL} | | | | 14 | 21 | | | | | |
| t_{PLH} | B | Q_C | | 24 | 39 | | | | ns | |
| t_{PHL} | | | | 26 | 39 | | | | | |
| t_{PLH} | B | Q_D | | 13 | 21 | | | | ns | |
| t_{PHL} | | | | 14 | 21 | | | | | |
| t_{PHL} | Clear | Any | | 24 | 39 | | 24 | 39 | ns | |

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

SN54390, SN54LS390, SN54393, SN54LS393
 SN74390, SN74LS390, SN74393, SN74LS393
 DUAL 4-BIT DECADE AND BINARY COUNTERS

SDLS107 - OCTOBER 1976 - REVISED MARCH 1988

PARAMETER MEASUREMENT INFORMATION



NOTE A: Input pulses are supplied by a generator having the following characteristics $t_r \leq 5 \text{ ns}$, $t_f \leq 5 \text{ ns}$, $\text{PRR} = 1 \text{ MHz}$, duty cycle = 50%, $Z_{out} \approx 50 \text{ ohms}$.

FIGURE 1

SN54390, SN54LS390, SN54393, SN54LS393 SN74390, SN74LS390, SN74393, SN74LS393 DUAL 4-BIT DECADE AND BINARY COUNTERS

SDLS107 – OCTOBER 1976 – REVISED MARCH 1988

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

| | |
|--|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Clear input voltage | 7 V |
| Any A or B clock input voltage | 5.5 V |
| Operating free-air temperature range: SN54LS390, SN54LS393 | -55°C to 125°C |
| SN74LS390, SN74LS393 | 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

| | SN54LS390 SN54LS393 | | | SN74LS390 SN74LS393 | | | 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} | | | -400 | | | -400 | μ A | |
| Low-level output current, I_{OL} | | | 4 | | | 8 | mA | |
| Count frequency, f_{count} | A input | | 0 | 25 | 0 | | 25 | MHz |
| | B input | | 0 | 12.5 | 0 | | 12.5 | |
| Pulse width, t_w | A input high or low | | 20 | | 20 | | ns | |
| | B input high or low | | 40 | | 40 | | | |
| | Clear high | | 20 | | 20 | | | |
| Clear inactive-state setup time, t_{SU} | 25 \downarrow | | 25 \downarrow | | | | ns | |
| Operating free-air temperature, T_A | -55 | | 125 | | 0 | | 70 | °C |

\downarrow The arrow indicates that the falling edge of the clock pulse is used for reference.

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

| PARAMETER | TEST CONDITIONS [†] | SN54LS' | | | SN74LS' | | | UNIT |
|--|---|--|------------------|-----------------------|---------|------------------|------|------|
| | | MIN | TYP [‡] | MAX | MIN | TYP [‡] | MAX | |
| V_{IH} High-level input voltage | | 2 | | | 2 | | | V |
| V_{IL} Low-level input voltage | | 0.7 | | | 0.8 | | | V |
| V_{IK} Input clamp voltage | $V_{CC} = \text{MIN}, I_I = -18 \text{ mA}$ | -1.5 | | | -1.5 | | | V |
| V_{OH} High-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = V_{IL \text{ max}}, I_{OH} = -400 \mu\text{A}$ | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| V_{OL} Low-level output voltage | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V},$ | $I_{OL} = 4 \text{ mA}$ [¶] | | 0.25 | 0.4 | 0.25 | 0.4 | V |
| | | $I_{OL} = 8 \text{ mA}$ [¶] | | | | 0.35 | 0.5 | |
| I_I Input current at maximum input voltage | Clear | $V_{CC} = \text{MAX}$ | | $V_I = 7 \text{ V}$ | | 0.1 | 0.1 | mA |
| | Input A | | | $V_I = 5.5 \text{ V}$ | | 0.2 | 0.2 | |
| | Input B | | | | | 0.4 | 0.4 | |
| I_{IH} High-level input current | Clear | $V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$ | | | | 0.02 | 0.02 | mA |
| | Input A | | | | | 0.1 | 0.1 | |
| | Input B | | | | | 0.2 | 0.2 | |
| I_{IL} Low-level input current | Clear | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$ | | | | -0.4 | -0.4 | mA |
| | Input A | | | | | -1.6 | -1.6 | |
| | Input B | | | | | -2.4 | -2.4 | |
| I_{OS} Short-circuit output current [§] | $V_{CC} = \text{MAX}$ | -20 | -100 | -20 | -100 | | | mA |
| I_{CC} Supply current | $V_{CC} = \text{MAX},$ See Note 2 | 'LS390 | | 15 | 26 | 15 | 26 | mA |
| | | 'LS393 | | 15 | 26 | 15 | 26 | |

[†] 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 of the short-circuit should not exceed one second.

[¶] The Q_A outputs of the 'LS390 are tested at $I_{OL} = \text{MAX}$ plus the limit value for I_{IL} for the clock B input. This permits driving the clock B input while maintaining full fan-out capability.

NOTE 2: I_{CC} is measured with all outputs open, both clear inputs grounded following momentary connection to 4.5 V, and all other inputs grounded.



**SN54390, SN54LS390, SN54393, SN54LS393
 SN74390, SN74LS390, SN74393, SN74LS393
 DUAL 4-BIT DECADE AND BINARY COUNTERS**

SDLS107 – OCTOBER 1976 – REVISED MARCH 1988

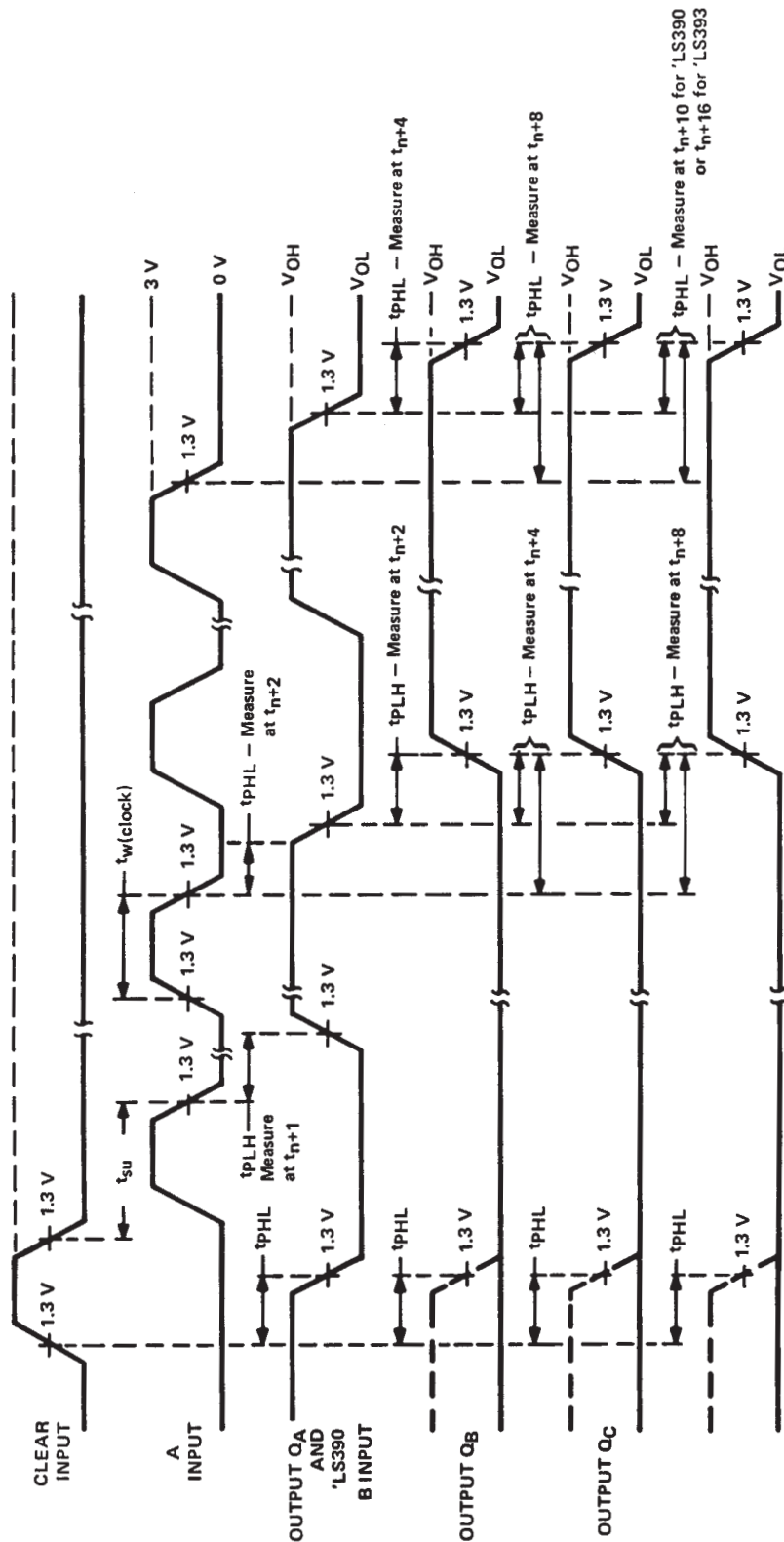
switching characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | 'LS390 | | | 'LS393 | | | UNIT |
|------------|-----------------|------------------------------------|---|--------|-----|-----|--------|-----|-----|------|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | |
| f_{\max} | A | Q_A | $C_L = 15\text{ pF}$, $R_L = 2\text{ k}\Omega$, See Note 4 and Figure 2 | 25 | 35 | | 25 | 35 | MHz | |
| | B | Q_B | | 12.5 | 20 | | | | | |
| t_{PLH} | A | Q_A | | 12 | 20 | | 12 | 20 | ns | |
| t_{PHL} | | | | 13 | 20 | | 13 | 20 | | |
| t_{PLH} | A | Q_C of 'LS390 Q_D of 'LS393 | | 37 | 60 | | 40 | 60 | ns | |
| t_{PHL} | | | | 39 | 60 | | 40 | 60 | | |
| t_{PLH} | B | Q_B | | 13 | 21 | | | | ns | |
| t_{PHL} | | | | 14 | 21 | | | | | |
| t_{PLH} | B | Q_C | | 24 | 39 | | | | ns | |
| t_{PHL} | | | | 26 | 39 | | | | | |
| t_{PLH} | B | Q_D | | 13 | 21 | | | | ns | |
| t_{PHL} | | | | 14 | 21 | | | | | |
| t_{PHL} | Clear | Any | | 24 | 39 | | 24 | 39 | ns | |

NOTE 4: Load circuits and voltage waveforms are shown in Section 1.



PARAMETER MEASUREMENT INFORMATION



VOLTAGE WAVEFORMS

NOTE A: Input pulses are supplied by a generator having the following characteristics $t_r \leq 15$ ns, $t_f \leq 6$ ns, PRR = 1 MHz, duty cycle = 50 %, $Z_{out} \approx 50$ ohms.

FIGURE 2

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 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------------------|-------------------------|
| 7802601EA | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601EA SNJ54LS390J | Samples |
| 7802601FA | ACTIVE | CFP | W | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601FA SNJ54LS390W | Samples |
| 7802601FA | ACTIVE | CFP | W | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601FA SNJ54LS390W | Samples |
| JM38510/32701B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701B2A | Samples |
| JM38510/32701B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701B2A | Samples |
| JM38510/32701BEA | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701BEA | Samples |
| JM38510/32701BEA | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701BEA | Samples |
| JM38510/32702B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702B2A | Samples |
| JM38510/32702B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702B2A | Samples |
| JM38510/32702BCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BCA | Samples |
| JM38510/32702BCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BCA | Samples |
| JM38510/32702BDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BDA | Samples |
| JM38510/32702BDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BDA | Samples |
| JM38510/32702SDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702SDA SNV54LS393W | Samples |
| JM38510/32702SDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702SDA SNV54LS393W | Samples |
| M38510/32701B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701B2A | 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 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------------------|-------------------------|
| M38510/32701B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701B2A | Samples |
| M38510/32701BEA | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701BEA | Samples |
| M38510/32701BEA | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32701BEA | Samples |
| M38510/32702B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702B2A | Samples |
| M38510/32702B2A | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702B2A | Samples |
| M38510/32702BCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BCA | Samples |
| M38510/32702BCA | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BCA | Samples |
| M38510/32702BDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BDA | Samples |
| M38510/32702BDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702BDA | Samples |
| M38510/32702SDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702SDA SNV54LS393W | Samples |
| M38510/32702SDA | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | JM38510/ 32702SDA SNV54LS393W | Samples |
| SN54LS390J | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54LS390J | Samples |
| SN54LS390J | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54LS390J | Samples |
| SN54LS393J | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54LS393J | Samples |
| SN54LS393J | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SN54LS393J | Samples |
| SN74LS390D | ACTIVE | SOIC | D | 16 | 40 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS390 | Samples |
| SN74LS390D | ACTIVE | SOIC | D | 16 | 40 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS390 | 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 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|--------------------------|-------------------------|
| SN74LS390N | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS390N | Samples |
| SN74LS390N | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS390N | Samples |
| SN74LS390NE4 | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS390N | Samples |
| SN74LS390NE4 | ACTIVE | PDIP | N | 16 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS390N | Samples |
| SN74LS390NSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS390 | Samples |
| SN74LS390NSR | ACTIVE | SO | NS | 16 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS390 | Samples |
| SN74LS393DR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS393 | Samples |
| SN74LS393DR | ACTIVE | SOIC | D | 14 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | LS393 | Samples |
| SN74LS393N | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS393N | Samples |
| SN74LS393N | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS393N | Samples |
| SN74LS393NE4 | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS393N | Samples |
| SN74LS393NE4 | ACTIVE | PDIP | N | 14 | 25 | RoHS & Green | NIPDAU | N / A for Pkg Type | 0 to 70 | SN74LS393N | Samples |
| SN74LS393NSR | ACTIVE | SO | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS393 | Samples |
| SN74LS393NSR | ACTIVE | SO | NS | 14 | 2000 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | 0 to 70 | 74LS393 | Samples |
| SNJ54LS390FK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS390FK | Samples |
| SNJ54LS390FK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS390FK | Samples |
| SNJ54LS390J | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601EA SNJ54LS390J | Samples |
| SNJ54LS390J | ACTIVE | CDIP | J | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601EA SNJ54LS390J | Samples |
| SNJ54LS390W | ACTIVE | CFP | W | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601FA SNJ54LS390W | Samples |
| SNJ54LS390W | ACTIVE | CFP | W | 16 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | 7802601FA SNJ54LS390W | 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 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SNJ54LS393FK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS393FK | Samples |
| SNJ54LS393FK | ACTIVE | LCCC | FK | 20 | 55 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS393FK | Samples |
| SNJ54LS393J | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS393J | Samples |
| SNJ54LS393J | ACTIVE | CDIP | J | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS393J | Samples |
| SNJ54LS393W | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS393W | Samples |
| SNJ54LS393W | ACTIVE | CFP | W | 14 | 25 | Non-RoHS & Green | SNPB | N / A for Pkg Type | -55 to 125 | SNJ54LS393W | 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.

OBSELETE: 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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN54LS390, SN54LS393, SN54LS393-SP, SN74LS390, SN74LS393 :

- Catalog : [SN74LS390](#), [SN74LS393](#), [SN54LS393](#)

- Military : [SN54LS390](#), [SN54LS393](#)

- Space : [SN54LS393-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

- Military - QML certified for Military and Defense Applications

- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



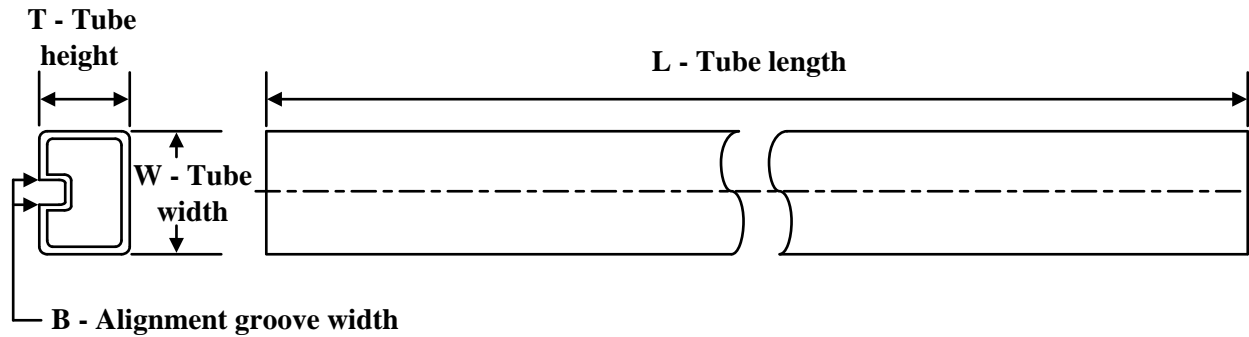
*All dimensions are nominal

| 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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS390NSR | SO | NS | 16 | 2000 | 330.0 | 16.4 | 8.2 | 10.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74LS393DR | SOIC | D | 14 | 2500 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| SN74LS393NSR | SO | NS | 14 | 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) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS390NSR | SO | NS | 16 | 2000 | 356.0 | 356.0 | 35.0 |
| SN74LS393DR | SOIC | D | 14 | 2500 | 356.0 | 356.0 | 35.0 |
| SN74LS393NSR | SO | NS | 14 | 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) |
|------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 7802601FA | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |
| JM38510/32701B2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| JM38510/32702B2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| JM38510/32702BDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| JM38510/32702SDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| M38510/32701B2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| M38510/32702B2A | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| M38510/32702BDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| M38510/32702SDA | W | CFP | 14 | 25 | 506.98 | 26.16 | 6220 | NA |
| SN74LS390D | D | SOIC | 16 | 40 | 507 | 8 | 3940 | 4.32 |
| SN74LS390N | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS390N | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS390NE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS390NE4 | N | PDIP | 16 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS393N | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS393N | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS393NE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SN74LS393NE4 | N | PDIP | 14 | 25 | 506 | 13.97 | 11230 | 4.32 |
| SNJ54LS390FK | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| SNJ54LS390W | W | CFP | 16 | 25 | 506.98 | 26.16 | 6220 | NA |
| SNJ54LS393FK | FK | LCCC | 20 | 55 | 506.98 | 12.06 | 2030 | NA |
| SNJ54LS393W | W | CFP | 14 | 25 | 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



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.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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.

W (R-GDFP-F14)

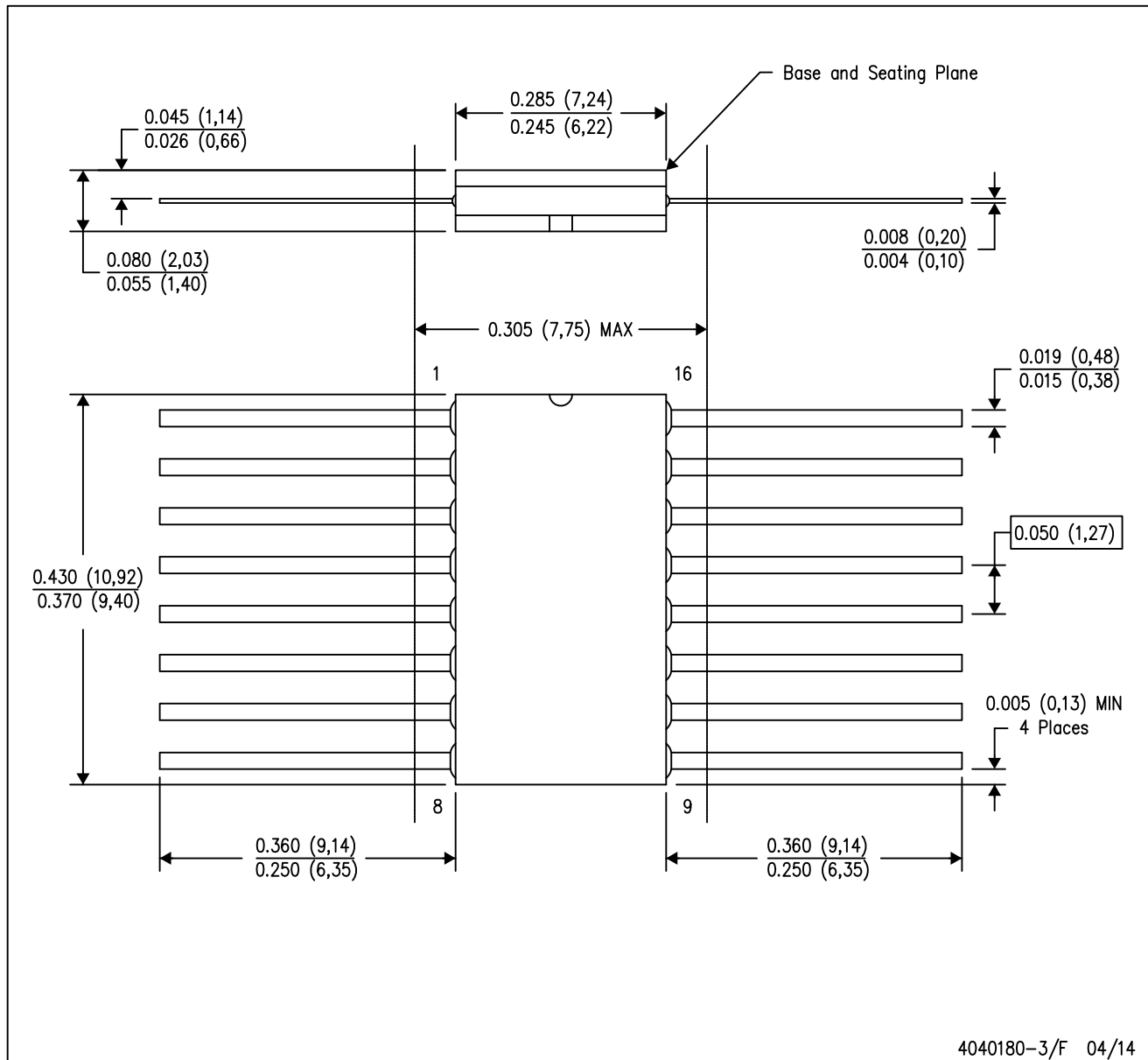
CERAMIC DUAL FLATPACK



- 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 GDFP1-F14

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) |

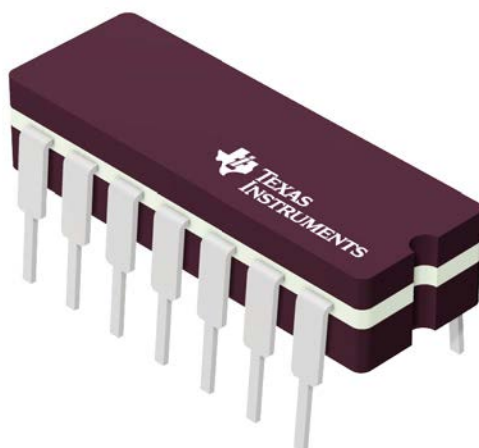


4040083/F 03/03

- 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.

J 14

GENERIC PACKAGE VIEW
CDIP - 5.08 mm max height
CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4040083-5/G

J0014A



PACKAGE OUTLINE

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



4214771/A 05/2017

NOTES:

1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermetically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

EXAMPLE BOARD LAYOUT

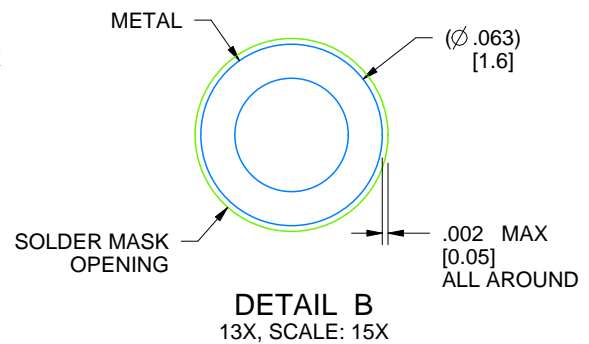
J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



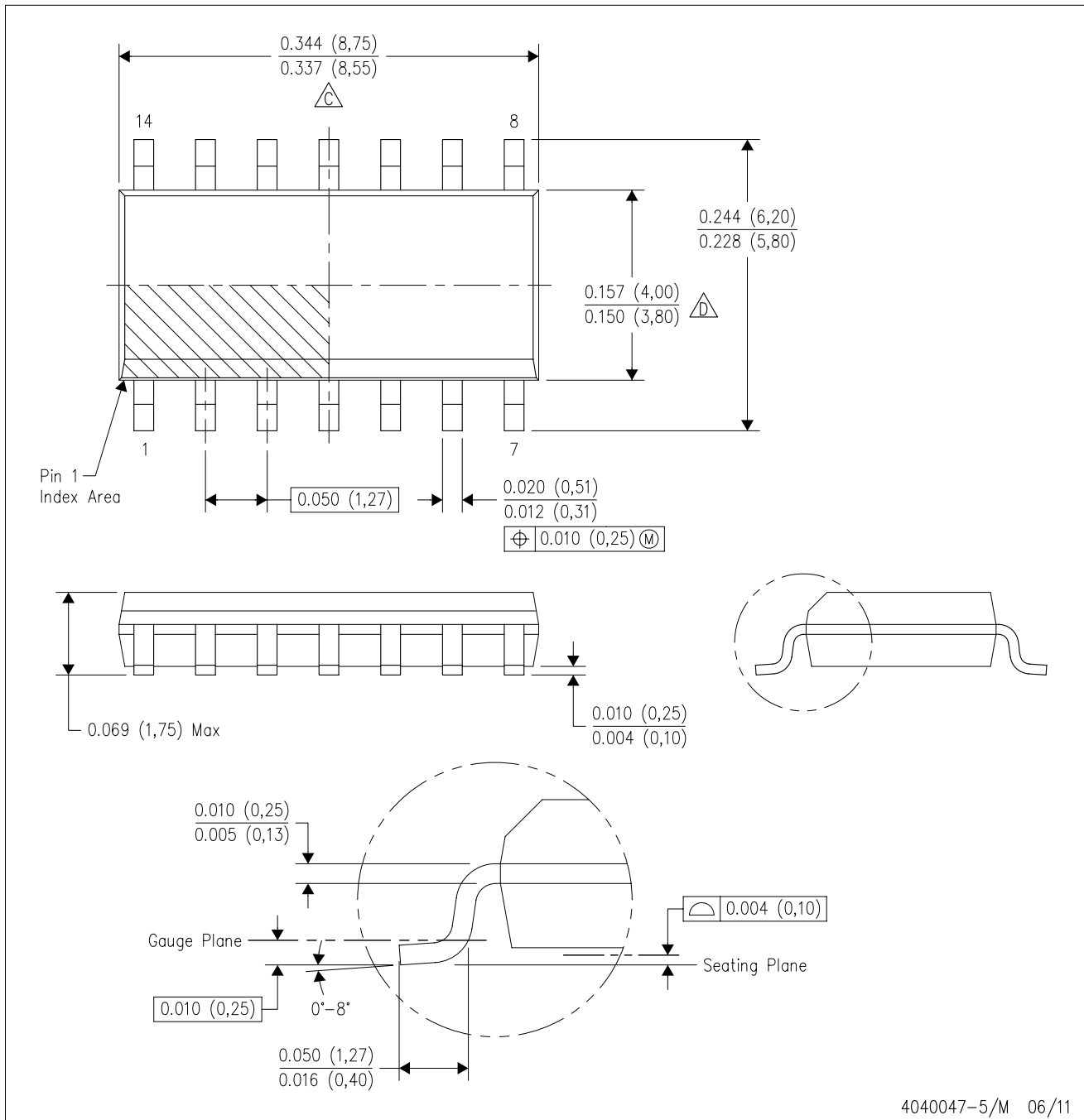
LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X



4214771/A 05/2017

D (R-PDSO-G14)

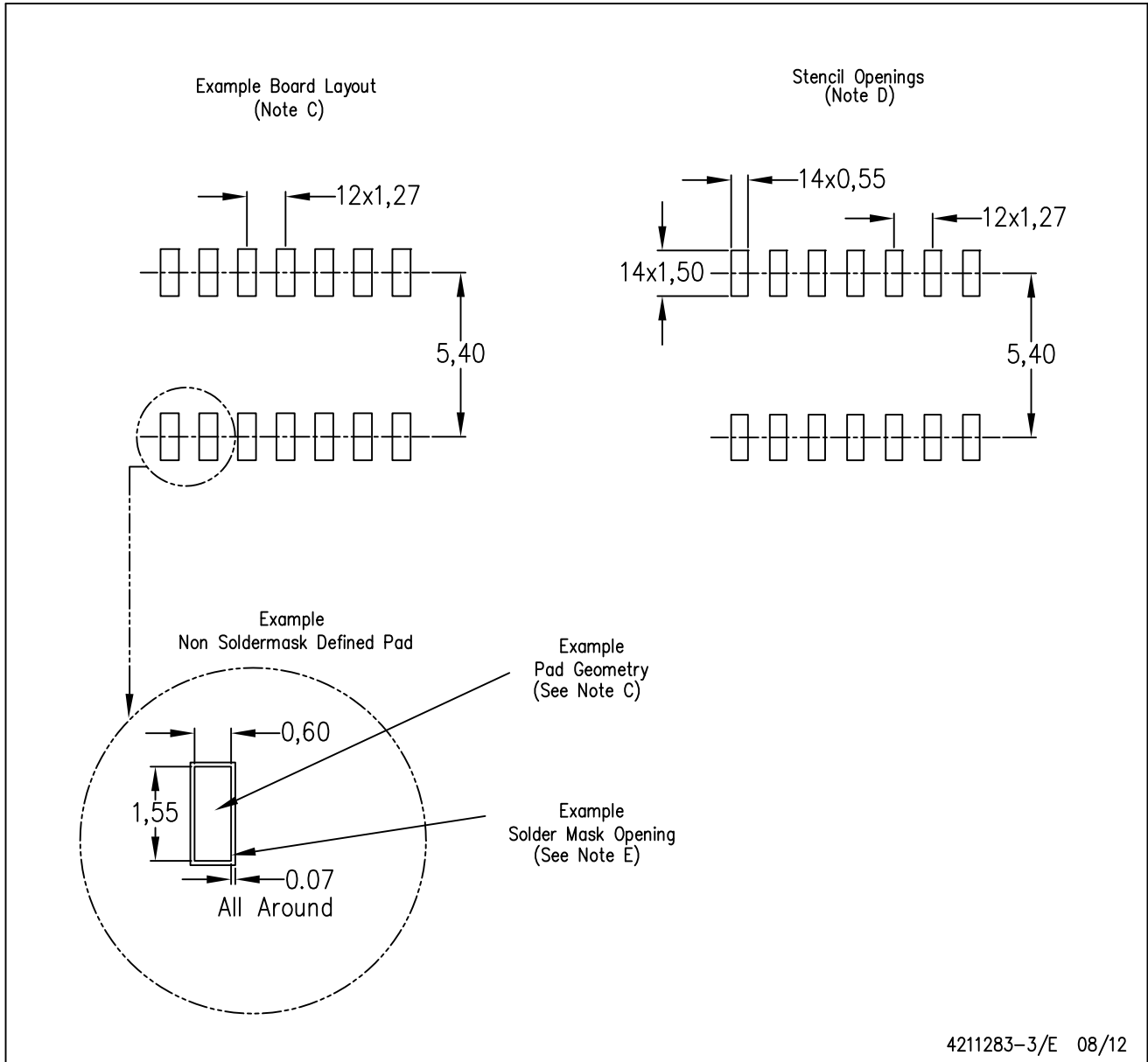
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AB.

D (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4211283-3/E 08/12

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2024, Texas Instruments Incorporated

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View JM38510/32702BCA on WIN SOURCE](#)

 [Texas Instruments](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management