

# SN55114, SN75114 DUAL DIFFERENTIAL LINE DRIVERS

SLLS071C – SEPTEMBER 1973 – REVISED SEPTEMBER 1998

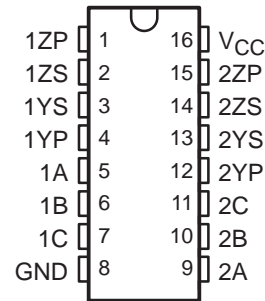
- Choice of Open-Collector, Open-Emitter, or Totem-Pole Outputs
- Single-Ended or Differential AND/NAND Outputs
- Single 5-V Supply
- Dual-Channel Operation
- TTL Compatible
- Short-Circuit Protection
- High-Current Outputs
- Triple inputs
- Clamp Diodes at Inputs and Outputs
- Designed for Use With SN55115 and SN75115 Differential Line Receivers
- Designed to Be Interchangeable With National DS9614 Line Driver

## description

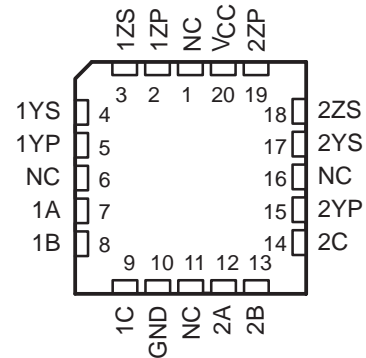
The SN55114 and SN75114 dual differential line drivers are designed to provide differential output signals with the high-current capability for driving balanced lines, such as twisted pair, at normal line impedances without high power dissipation. The output stages are similar to TTL totem-pole outputs, but with the sink outputs, YS and ZS, and the corresponding active pullup terminals, YP and ZP, available on adjacent package pins. Since the output stages provide TTL-compatible output levels, these devices can also be used as TTL expanders or phase splitters.

The SN55114 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN75114 is characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

SN55114 . . . J OR W PACKAGE  
SN75114 . . . D OR N PACKAGE  
(TOP VIEW)



SN55114 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

FUNCTION TABLE

| INPUTS                       |   |   | OUTPUTS |   |
|------------------------------|---|---|---------|---|
| A                            | B | C | Y       | Z |
| H                            | H | H | H       | L |
| All other input combinations |   |   | L       | H |

H = high level, L = low level



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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**

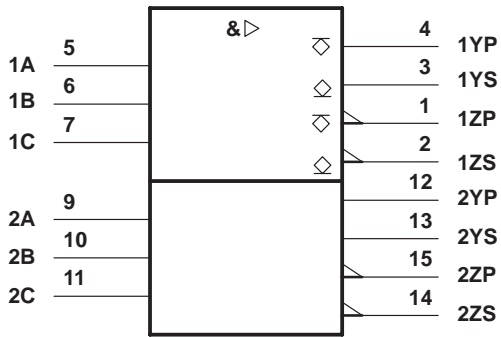
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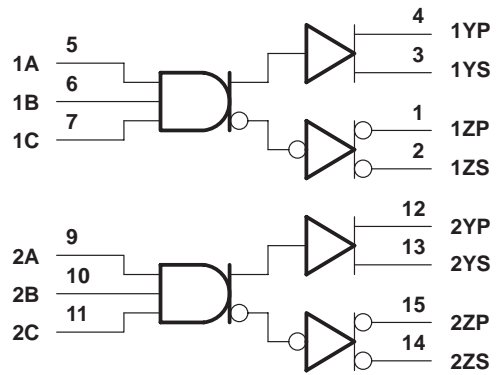
# SN55114, SN75114 DUAL DIFFERENTIAL LINE DRIVERS

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## logic symbol†



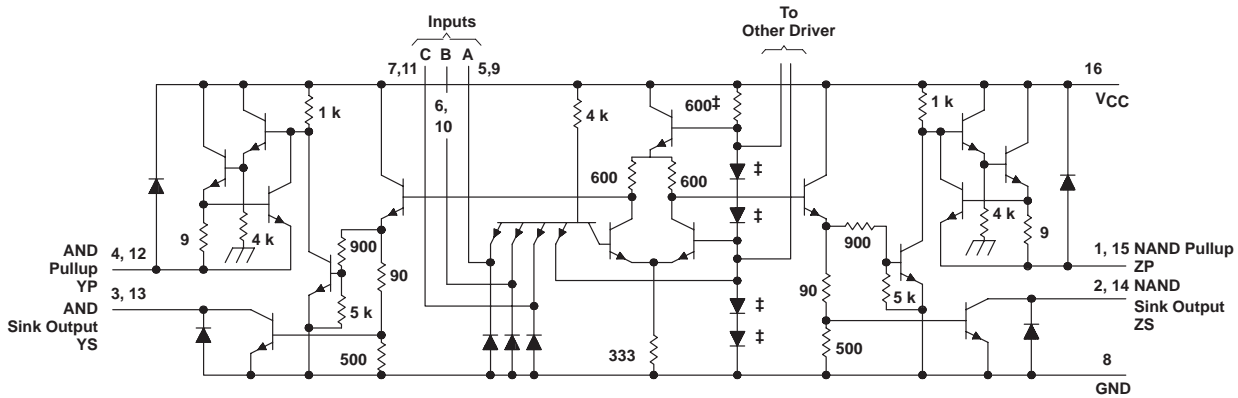
## logic diagram (positive logic)



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

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

## schematic (each driver)



‡ These components are common to both drivers. Resistor values shown are nominal and in ohms.

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

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

|  |                              |
|--|------------------------------|
| Supply voltage, $V_{CC}$ (see Note 1)  | 7 V                          |
| Input voltage, $V_I$   | 5.5 V                        |
| Off-state voltage applied to open-collector outputs                          | 12 V                         |
| Continuous total power dissipation   | See Dissipation Rating Table |
| Storage temperature range, $T_{stg}$   | –65°C to 150°C               |
| Case temperature for 60 seconds, $T_C$ : FK package                          | 260°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J or W package | 300°C                        |
| Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or N package | 260°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.

NOTES: 1. All voltage values are with respect to the network ground terminal.

**DISSIPATION RATING TABLE**

| PACKAGE | $T_A \leq 25^\circ\text{C}$<br>POWER RATING | DERATING FACTOR<br>ABOVE $T_A = 25^\circ\text{C}$ | $T_A = 70^\circ\text{C}$<br>POWER RATING | $T_A = 125^\circ\text{C}$<br>POWER RATING |
|---------|---|---|--|---|
| D       | 950 mW                                      | 7.6 mW/°C   | 608 mW                                   | —   |
| FK‡     | 1375 mW                                     | 11.0 mW/°C  | 880 mW                                   | 275 mW                                    |
| J‡      | 1375 mW                                     | 11.0 mW/°C  | 880 mW                                   | 275 mW                                    |
| N       | 1150 mW                                     | 9.2 mW/°C   | 736 mW                                   | —   |
| W‡      | 1000 mW                                     | 8.0 mW/°C   | 640 mW                                   | 200 mW                                    |

‡ In the FK, J, and W packages, SN55114 chips are either silver glass or alloy mounted.

## recommended operating conditions (unless otherwise noted)

|                                       | SN55114 |     |     | SN75114 |     |      | UNIT |
|---------------------------------------|---------|-----|-----|---------|-----|------|------|
|                                       | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| Supply voltage, $V_{CC}$              | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| High-level input voltage, $V_{IH}$    | 2       |     |     | 2       |     |      | V    |
| Low-level input voltage, $V_{IL}$     |         |     | 0.8 |         |     | 0.8  | V    |
| High-level output current, $I_{OH}$   |         |     | –40 |         |     | –40  | mA   |
| Low-level output current, $I_{OL}$    |         |     | 40  |         |     | 40   | mA   |
| Operating free-air temperature, $T_A$ | –55     |     | 125 | 0       |     | 70   | °C   |



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

| PARAMETER   | TEST CONDITIONS†   | SN55114                  |                        |      | SN75114 |      |      | UNIT |     |    |
|---|--|--------------------------|------------------------|------|---------|------|------|------|-----|----|
|   |  | MIN                      | TYP‡                   | MAX  | MIN     | TYP‡ | MAX  |      |     |    |
| V <sub>IK</sub> Input clamp voltage                         | V <sub>CC</sub> = MIN, I <sub>I</sub> = -12 mA   | -0.9                     | -1.5                   |      | -0.9    | -1.5 |      | V    |     |    |
| V <sub>OH</sub> High-level output voltage                   | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V                          | I <sub>OH</sub> = -10 mA |                        |      | 2.4     | 3.4  |      | 2.4  | 3.4 | V  |
|   |  | I <sub>OH</sub> = -40 mA |                        |      | 2       | 3    |      | 2    | 3   |    |
| V <sub>OL</sub> Low-level output voltage                    | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 40 mA |                          | 0.2                    | 0.4  |         | 0.2  | 0.45 |      | V   |    |
| V <sub>OK</sub> Output clamp voltage                        | V <sub>CC</sub> = 5 V, I <sub>O</sub> = 40 mA, T <sub>A</sub> = 25°C                           |                          | 6.1                    | 6.5  |         | 6.1  | 6.5  |      | V   |    |
|   | V <sub>CC</sub> = MAX, I <sub>O</sub> = -40 mA, T <sub>A</sub> = 25°C                          |                          | -1.1                   | -1.5 |         | -1.1 | -1.5 |      |     |    |
| I <sub>O(off)</sub> Off-state open collector output current | V <sub>CC</sub> = MAX  | V <sub>OH</sub> = 12 V   | T <sub>A</sub> = 25°C  |      |         | 1    | 100  |      |     | μA |
|   |  |                          | T <sub>A</sub> = 125°C |      |         |      | 200  |      |     |    |
|   |  | V <sub>OH</sub> = 5.25 V | T <sub>A</sub> = 25°C  |      |         |      |      | 1    | 100 |    |
|   |  |                          | T <sub>A</sub> = 70°C  |      |         |      |      |      | 200 |    |
| I <sub>I</sub> Input current at maximum input voltage       | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V  |                          |                        | 1    |         |      | 1    |      | mA  |    |
| I <sub>IH</sub> High-level input current                    | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V  |                          |                        | 40   |         |      | 40   |      | μA  |    |
| I <sub>IL</sub> Low-level input current                     | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V  |                          | -1.1                   | -1.6 |         |      | -1.1 | -1.6 | mA  |    |
| I <sub>OS</sub> Short-circuit output current§               | V <sub>CC</sub> = MAX, V <sub>O</sub> = 0, T <sub>A</sub> = 25°C                               | -40                      | -90                    | -120 | -40     | -90  | -120 |      | mA  |    |
| I <sub>CC</sub> Supply current (both drivers)               | All inputs at 0 V, No load, T <sub>A</sub> = 25°C  | V <sub>CC</sub> = MAX    |                        |      | 37      | 50   |      | 37   | 50  | mA |
|   |  | V <sub>CC</sub> = 7 V    |                        |      | 47      | 65   |      | 47   | 70  |    |

† All parameters, with the exception of off-state open-collector output current, are measured with the active pullup connected to the sink output. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at T<sub>A</sub> = 25°C and V<sub>CC</sub> = 5 V, with the exception of I<sub>CC</sub> at 7 V.

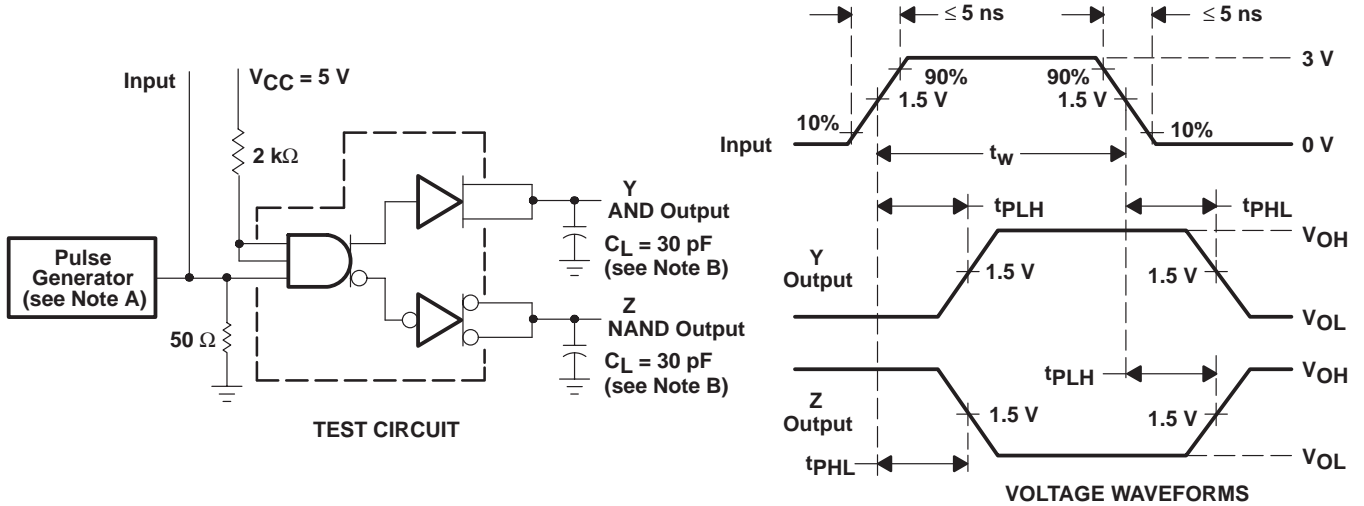
§ Only one output should be shorted at a time, and duration of the short circuit should not exceed one second.

## switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

| PARAMETER  | TEST CONDITIONS                      | SN55114 |     |     | SN75114 |     |     | UNIT |
|--|--------------------------------------|---------|-----|-----|---------|-----|-----|------|
|  |                                      | MIN     | TYP | MAX | MIN     | TYP | MAX |      |
| t <sub>PLH</sub> Propagation delay time, low- to high-level output | C <sub>L</sub> = 30 pF, See Figure 1 |         | 15  | 20  |         | 15  | 30  | ns   |
| t <sub>PHL</sub> Propagation delay time, high- to low-level output |                                      |         | 11  | 20  |         | 11  | 30  | ns   |



PARAMETER MEASUREMENT INFORMATION



NOTES: A. The pulse generator has the following characteristics:  $Z_O = 500 \Omega$ ,  $PRR \leq 500 \text{ kHz}$ ,  $t_w \leq 100 \text{ ns}$ .  
B.  $C_L$  includes probe and jig capacitance.

Figure 1. Test Circuit and Voltage Waveforms

TYPICAL CHARACTERISTICS†

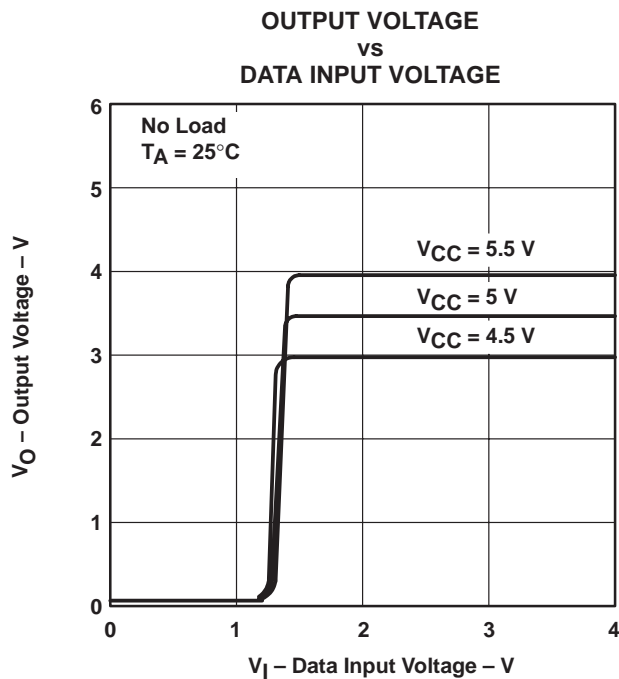


Figure 2

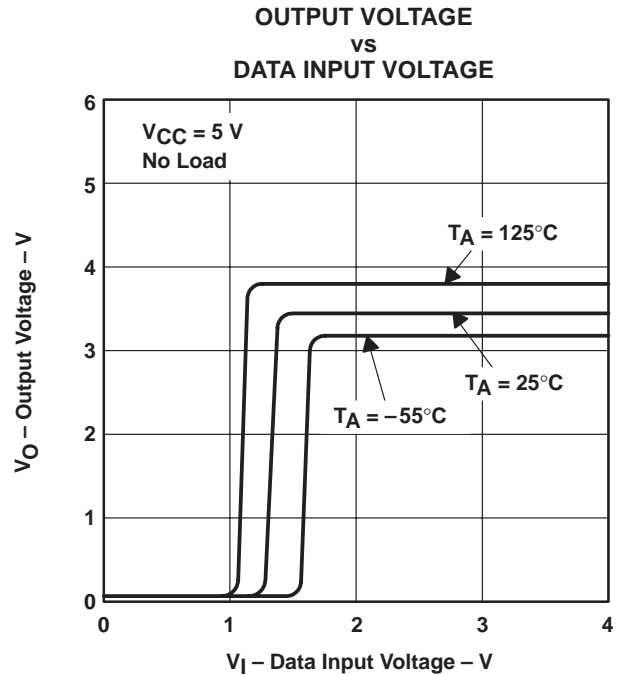


Figure 3

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. These parameters were measured with the active pullup connected to the sink output.

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## TYPICAL CHARACTERISTICS†

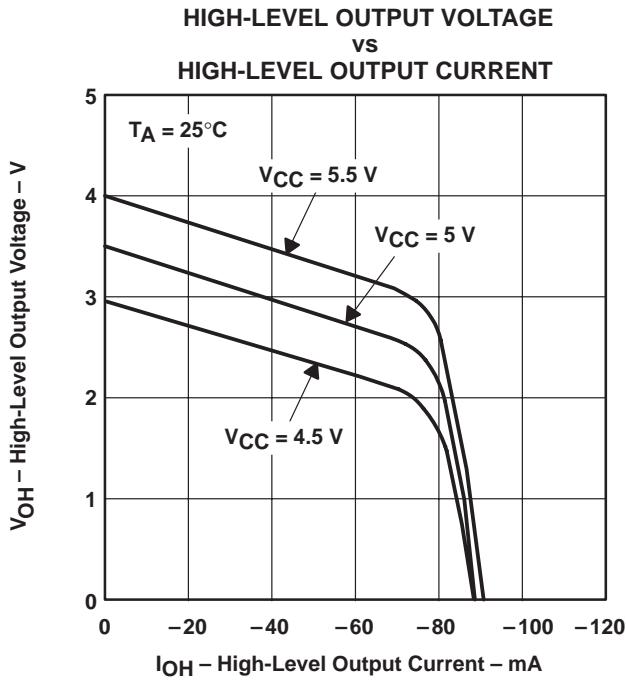


Figure 4

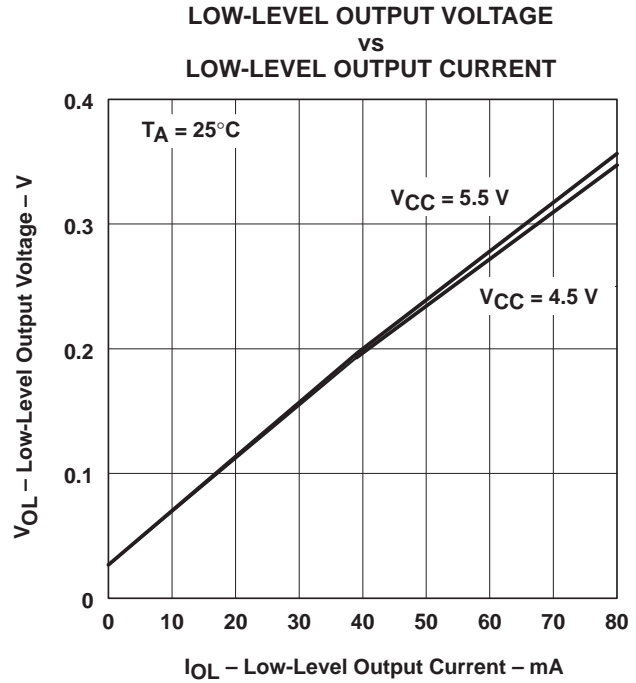


Figure 5

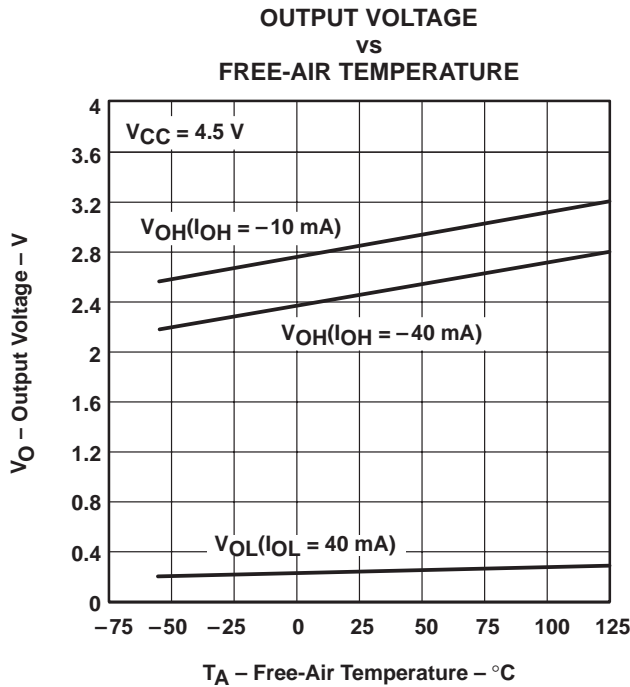


Figure 6

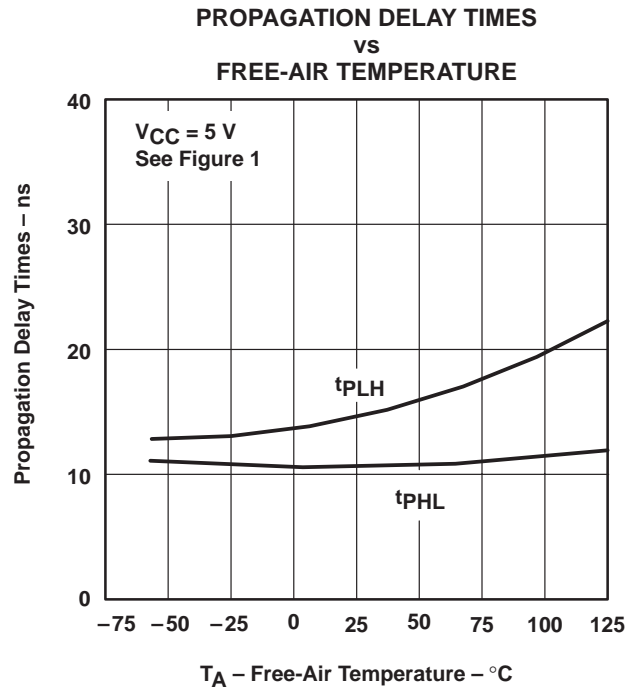


Figure 7

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. These parameters were measured with the active pullup connected to the sink output.

TYPICAL CHARACTERISTICS†

SUPPLY CURRENT  
 (BOTH DRIVERS)  
 vs  
 SUPPLY VOLTAGE

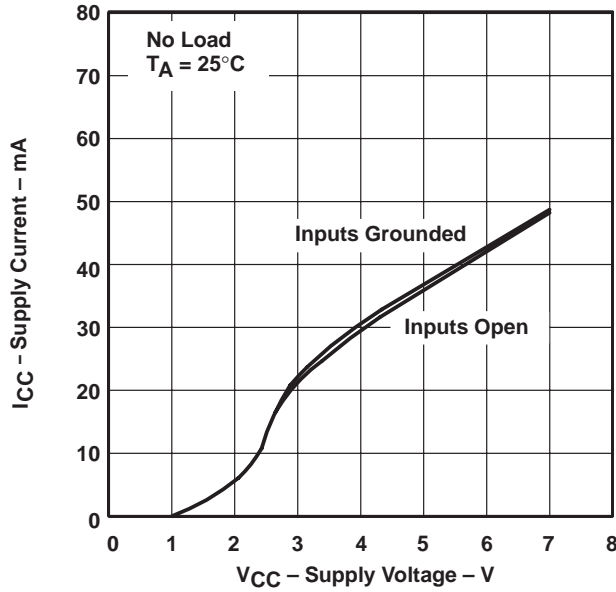


Figure 8

SUPPLY CURRENT  
 (BOTH DRIVERS)  
 vs  
 FREE-AIR TEMPERATURE

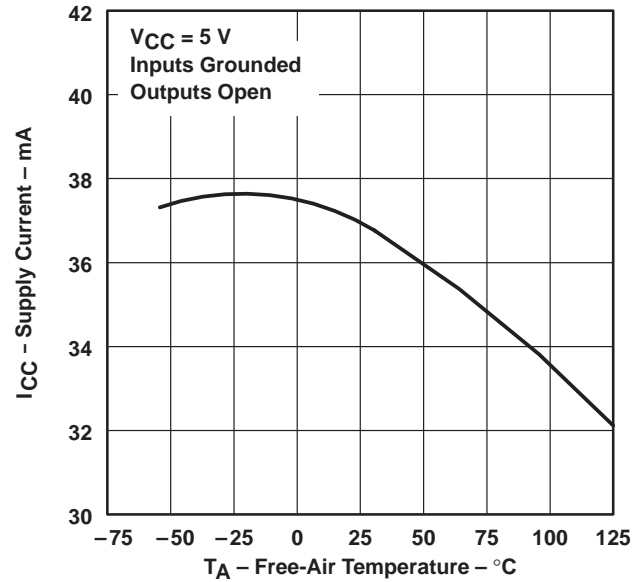


Figure 9

SUPPLY CURRENT  
 (BOTH DRIVERS)  
 vs  
 FREQUENCY

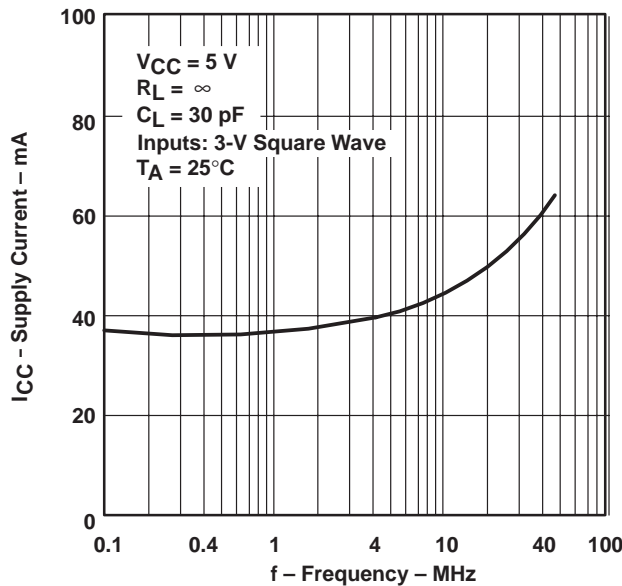


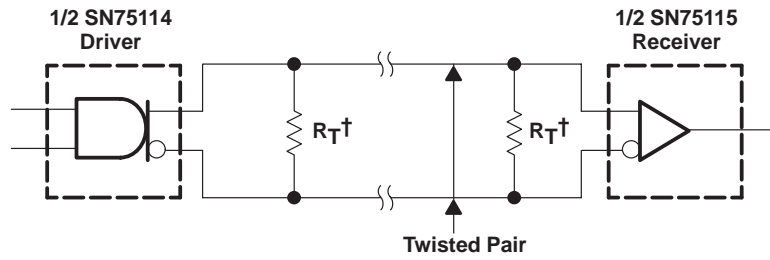
Figure 10

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. These parameters were measured with the active pullup connected to the sink output.

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## APPLICATION INFORMATION



$^\dagger R_T = Z_0$ . A capacitor can be connected in series with  $R_T$  to reduce power dissipation.

**Figure 11. Basic Party-Line or Data-Bus Differential Data Transmission**



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)  | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5)      | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|------------------------------|-------------------------|
| 5962-88744022A   | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-88744022A<br>SNJ55114FK | <a href="#">Samples</a> |
| 5962-8874402EA   | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8874402EA<br>SNJ55114J  | <a href="#">Samples</a> |
| 5962-8874402FA   | ACTIVE        | CFP          | W               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8874402FA<br>SNJ55114W  | <a href="#">Samples</a> |
| JM38510/10403BEA | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510<br>/10403BEA         | <a href="#">Samples</a> |
| M38510/10403BEA  | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | JM38510<br>/10403BEA         | <a href="#">Samples</a> |
| SN55114J         | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | SN55114J                     | <a href="#">Samples</a> |
| SN75114D         | ACTIVE        | SOIC         | D               | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | SN75114<br>9614CD            | <a href="#">Samples</a> |
| SN75114DE4       | ACTIVE        | SOIC         | D               | 16   | 40          | TBD              | Call TI                              | Call TI              | 0 to 70      |                              | <a href="#">Samples</a> |
| SN75114DG4       | ACTIVE        | SOIC         | D               | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-1-260C-UNLIM   | 0 to 70      | SN75114<br>9614CD            | <a href="#">Samples</a> |
| SN75114N         | ACTIVE        | PDIP         | N               | 16   | 25          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | SN75114N                     | <a href="#">Samples</a> |
| SNJ55114FK       | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-88744022A<br>SNJ55114FK | <a href="#">Samples</a> |
| SNJ55114J        | ACTIVE        | CDIP         | J               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8874402EA<br>SNJ55114J  | <a href="#">Samples</a> |
| SNJ55114W        | ACTIVE        | CFP          | W               | 16   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 5962-8874402FA<br>SNJ55114W  | <a href="#">Samples</a> |

(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  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm 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 SN55114, SN75114 :**

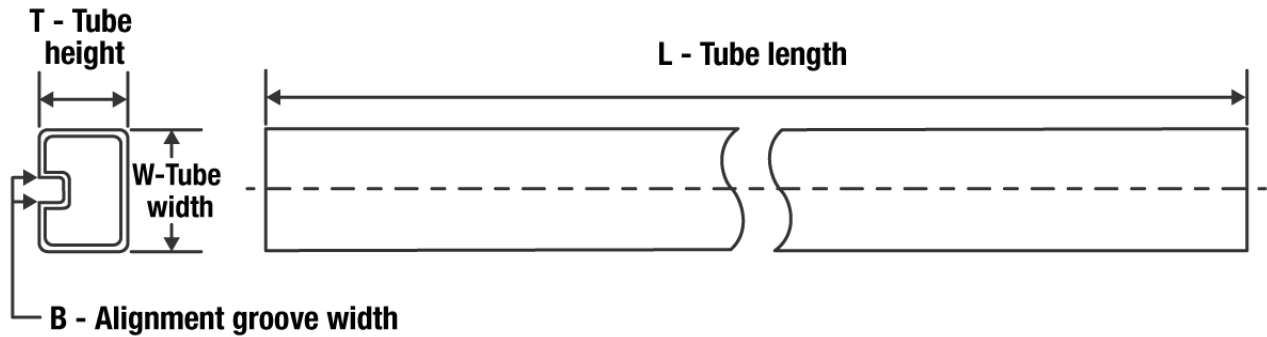
● Catalog : [SN75114](#)

● Military : [SN55114](#)

NOTE: Qualified Version Definitions:

● Catalog - TI's standard catalog product

● Military - QML certified for Military and Defense Applications

**TUBE**


\*All dimensions are nominal

| Device         | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|----------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| 5962-88744022A | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |
| SN75114D       | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN75114DE4     | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN75114DG4     | D            | SOIC         | 16   | 40  | 507    | 8      | 3940   | 4.32   |
| SN75114N       | N            | PDIP         | 16   | 25  | 506    | 13.97  | 11230  | 4.32   |
| SNJ55114FK     | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF TERMINALS ** | A                |                  | B                |                  |
|---------------------|------------------|------------------|------------------|------------------|
|                     | MIN              | MAX              | MIN              | MAX              |
| 20                  | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                  | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                  | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                  | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                  | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                  | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

- 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 AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4211283-4/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.

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

J (R-GDIP-T\*\*)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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

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